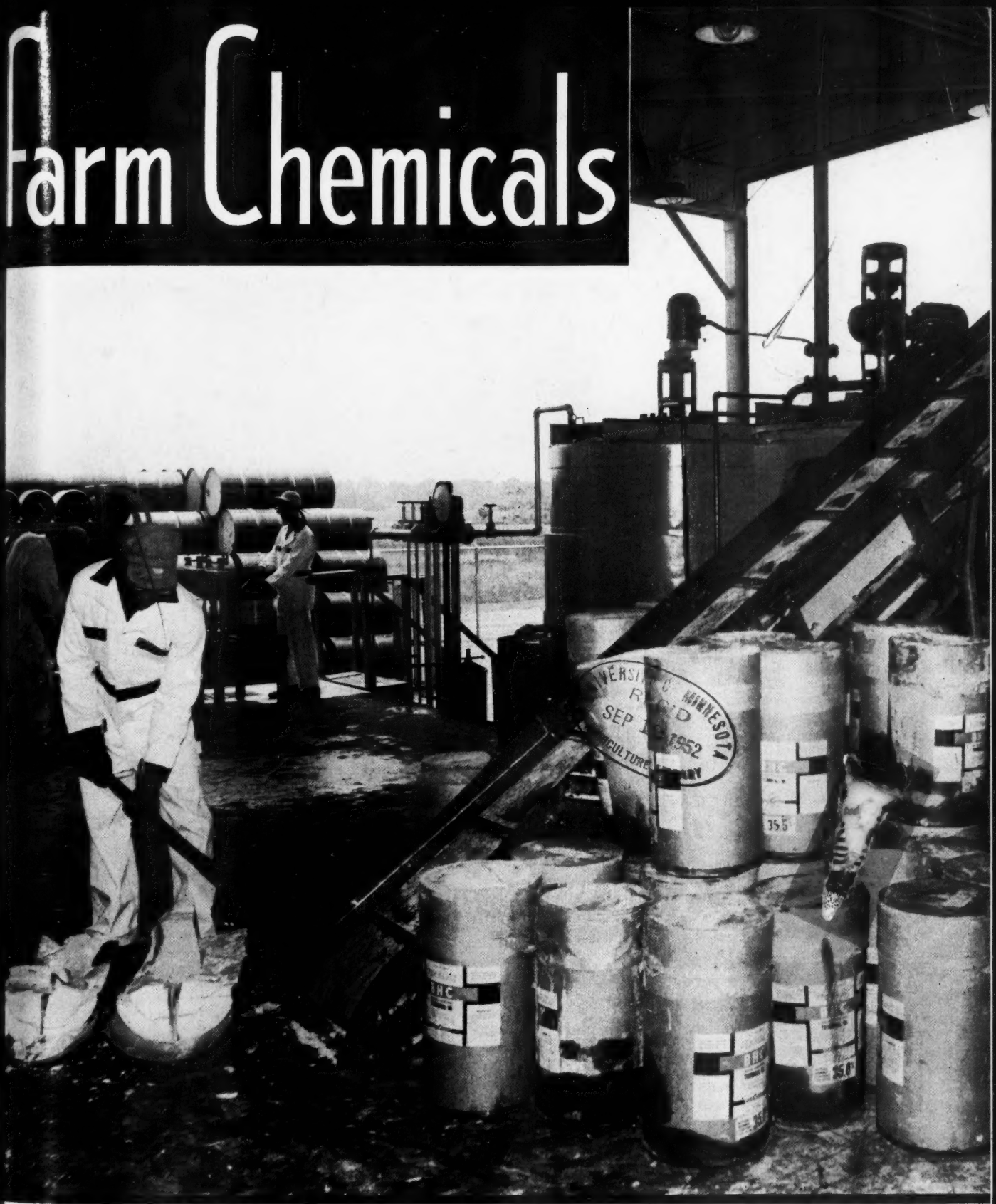
Farm Chemicals



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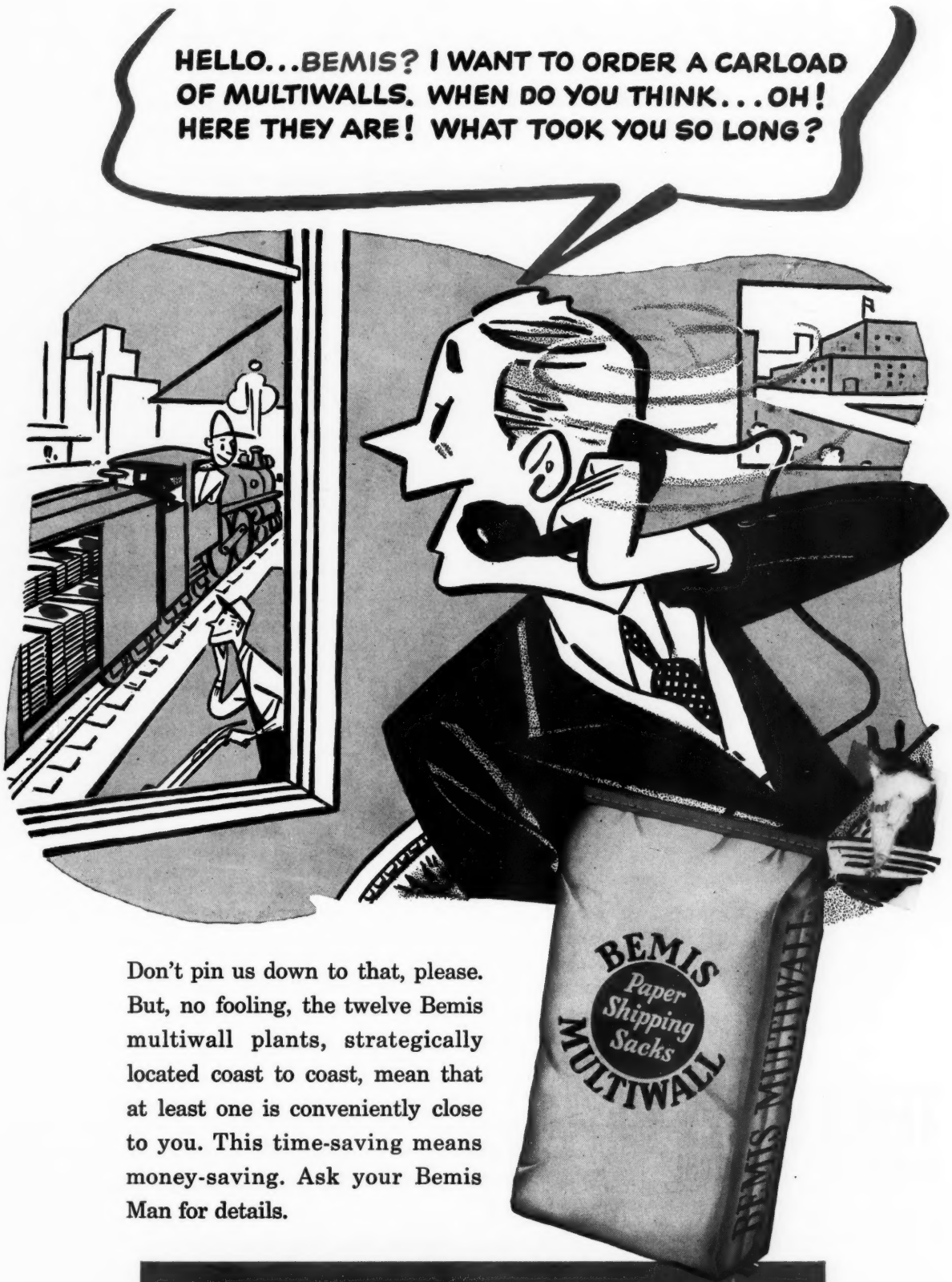

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In this issue . . .

Another record attendance at a farm chemicals convention was assured as we went to press by an announcement from the National Agricultural Chemicals Association that more than 400 delegates had been booked to attend the 19th annual meeting of the organization in Spring Lake, N. J., Sept. 3, 4 and 5. See convention story on page 12.

More and more attention will be required in the future for the production of chemical fertilizers high in plant food content for economical shipment to a wide market. That's the summary of Dr. Vincent Sauchelli and R. P. Taylor in their article on fertilizer mixing problems. It appears on page 15.

It is widely known that various horizons of the soil contribute different things to crop production. For data on a specific experiment with soil horizons and their contributions, read the article on page 19.

Methods by which diseases are spread from plant to plant is one of the most important phases of plant pathology—and one of the most neglected, according to W. L. Popham. He sheds new light on the part insects play in the spread of plant diseases in the article on page 25.

Reduced operating labor and improved product quality should result from replacing a batch-mixer with a funnel type continuous mixer, according to L. D. Yates and W. B. Williams, of the Tennessee Valley Authority. Description of such a mixer, used for acidulation of rock phosphate at TVA, is described on page 29.

Grasshoppers always have been destructive pests on western range and crop lands. Montana is one of the hardest hit states which the pest infests, hence, the state entomologist has issued some valuable suggestions for control of the grasshopper which have wide application for other areas. They appear on page 33.

Safety isn't just a local thing. More and more farm chemicals personnel are coming to realize the importance of safety for human and economic reasons. "Fertilizer Safety on a Nationwide Basis" is the topic of a talk given by J. S. Fields, chairman of the Fertilizer Section of the National Safety Council, which is printed on page 36.

A marked accumulation of available phosphorus in soils which had received large quantities of fertilizer was noted in New York state tests. Data revealed need for revision in fertilizer practices, according to M. T. Vittum, who writes about the tests on page 39.

Another fertilizer experiment with radioisotopes is outlined in this issue, on page 46. This one, by C. A. Black, deals with influence of placement and kind of fertilizer material on utilization of fertilizer phosphorus by crops. It was part of soil and fertilizer investigations with radioisotopes conducted last year.

farm chemicals

Formerly
American Fertilizer & Allied Chemicals
Established 1894
PIONEER JOURNAL OF THE FARM CHEMICALS INDUSTRY

Vol. 115 **SEPTEMBER, 1952** **No. 9**

Contents

Cover Story

Technical grade BHC, shipped from Natrona, Ala., is broken up and fed into melters for the preparation of emulsions at Pennsalt's new insecticide emulsion plant in Montgomery. Products are supplied for insecticide sprays used chiefly on cotton. Other photos, page 55.

A magazine international in scope and circulation and devoted to manufacturers, mixers, and formulators of fertilizers and pesticides

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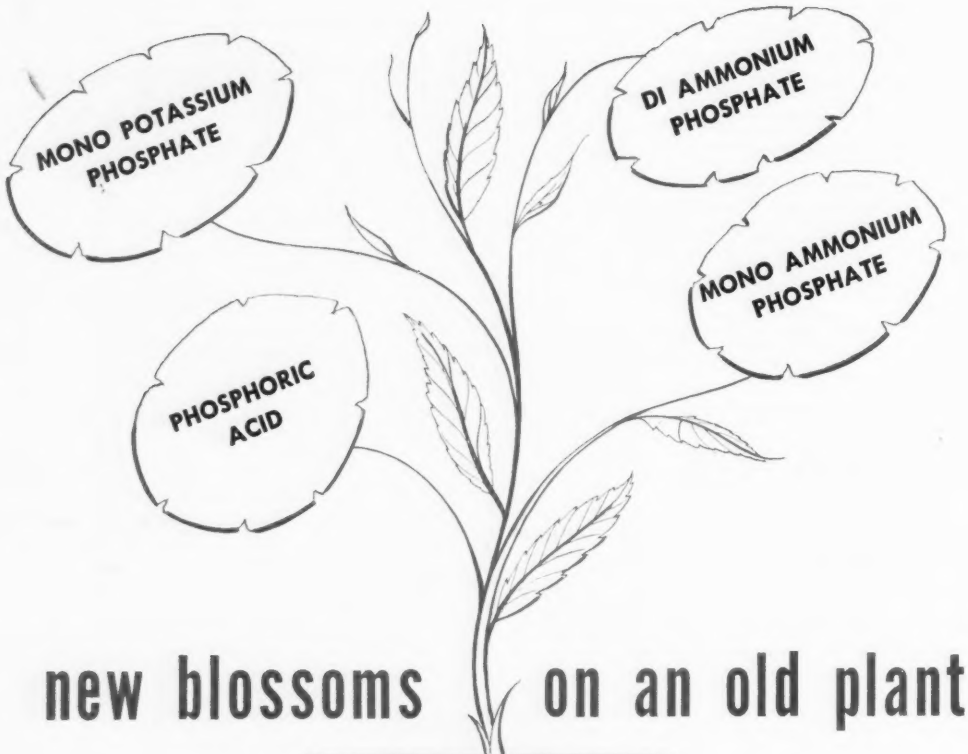

new blossoms on an old plant

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Phosphoric Acid (75.0%) (Liquid)	—0—	54.5%	—0—

farm chemicals facts

. . . Briefly Noted

USDA's Agricultural Research Administration now is advising farmers and home gardeners to use soil conditioners only on an experimental basis. Reason given is incomplete experimentation by the administration.

Best Fertilizers Co., Oakland, Cal., has purchased a 100-acre site near Stockton for construction of a new fertilizer plant. Initial construction costs will be more than $7,000,000 with $1,000,000 in additions already planned.

Northern Chemical Industries has appointed **George J. Odom** Chief Chemical Engineer of the Searsport, Me. plant. Odom comes from 29 years' service with Monsanto Chemical Company's Merrimac Division Branch. He is an authority on sulfuric acid and sulfate of alumina manufacture.

Walter S. Schamel, former assistant technical director in American Wheelabrator & Equipment Corporation's dust and fume control division, is now district manager of the Los Angeles office. Schamel is a graduate of Missouri School of Mines and Metallurgy.

James M. Gager Jr. is Kraft Bag Corporation's new sales representative in Chattanooga, Tenn. His area includes Tennessee, Georgia, South Carolina and part of North Carolina. He formerly was proprietor of the Gager Lime company.

Died: J. Bailey Pratt Jr., 61, a senior executive of H. J. Baker & Bro. Pratt, who joined Baker in 1923, served six years in in the Baltimore branch before moving to New York. He died at Manchester, Vt.

Irving D. Dawes and **Glenn L. Morrison** are new directors of regional controls of Controllers Institute. Dawes, Virginia-Carolina Chemical Corp. vice-president and treasurer, is a director of Richmond Control. Morrison, controller, General Chemical Corp., was named in Baltimore.

National Fertilizer Association's fall meeting will be held at the Roney Plaza Hotel, Miami Beach, Fla., Nov. 19–21.

Health Department inspectors in Akron, O. have cracked down on the use of unauthorized lindane insect-repellent dispensers. Officials said the dispensers give off too much heat, making them dangerous to humans.

A record $1,065,008 treble damage suit recently has been filed by OPS against Texas and California fertilizer firms accused of charging over-ceiling prices.

Died: Lammot du Pont, 71, past president of E. I. duPont deNemours & Co. (1926–1940). He was the eighth member of the duPont family and the third brother in succession to become head of the company founded by his great-grandfather in 1802.

R. F. Norcott is sales manager of Chase Bag Company sales department in Milwaukee. Norcott formerly was a Chase salesman in Buffalo and Chicago.

George K. Whyte, formerly Chase Bag Company's sales manager in St. Louis, is new manager of the firm's Factory and Sales office. Whyte, a graduate of the University of Illinois, has had 10 years' selling experience with Chase.

National Joint Committee on Fertilizer Application, in conjunction with American Society of Agronomy, meets in Cincinnati Nov. 17. Theme of the meeting, to be held at the Netherland Plaza Hotel, is "Keeping up with King Corn."

Died: Henry F. Kleinfeldt, vice-president of Abbe Engineering Company, New York. Kleinfeldt had been with Abbe for 40 years. He was active in the development of many mixing, pulverizing and blending process operations which are today standard practice.

Co-operative Fertilizer Service of Richmond, Inc. recently paid $15,000 for a 15-acre tract in Louisville, Ky. The land, adjacent to Louisville & Nashville Railroad yards, will be used as the site for Co-operative's new dry-mix fertilizer plant.

Correction: The lines describing the photographs of **primulas** and **camellias** on pages 17 and 18 of the August **Farm Chemicals** inadvertantly were switched in the article on Ferro Agricultural Frit.

Plant Shoot, a new concentrated, water-soluble plant nutrient is being marketed by Nott Manufacturing Company, Mount Vernon, N. Y. One pound of this 20–20–20 fertilizer has a potential acidity equivalent to 900 pounds per ton of calcium carbonate.

Davison Chemical Corp.'s employee publication, The Davison Sentinel, recently received National Safety Council's Certificate of Award for Exceptional Service to Safety. Cartoons, photographs and health columns by company doctors are among the services used by the publication to promote plant safety.

Raymond S. Clark is new counsel for Davison Chemical Corp. Clark, a graduate of Groton, Harvard College and Yale Law School, was engaged in private law practice before joining Davison. He succeeds H. Alexander Smith Jr.

A 12-man group has been chosen for the advisory board of the Plant Maintenance Show and Conference to be held at Cleveland's Public Auditorium, Jan. 19–22. Exhibits from 350 companies are expected. Clapp and Poliak, Inc. will conduct the events.

Sulfur: No Shortage— Of Predictions

Just as everyone in the farm chemicals industries had started to adjust himself to the critical shortage of sulfur, the economies and adjustments which it necessitated and the reduction in sulfuric acid output which it caused, news came a few weeks ago that the sulfur shortage had disappeared.

It had vanished, apparently, like those Arabs who folded their tents and silently stole away.

End of the shortage was acclaimed by Langbourne M. Williams Jr., president of Freeport Sulphur Co., but it brought quick rebuttal.

According to Williams, the situation has improved to the point where virtually all sulfur requirements in the United States are being met.

"The large gap between sulfur supply and demand no longer exists," he declared. "Although sulfur consumption is still under government limitation, all but a few consumers in this country are getting all the sulfur they need, and the situation abroad also has improved."

"The outlook for the future is extremely encouraging," he continued. "There is enough new production in sight to dispel the threat of a continuing shortage. Even if the requirements of U. S. industry and agriculture should increase by 1955 to the level estimated by the Defense Production Authority, there will be enough sulfur to meet the demand assuming the new projects measure up to expectations."

A further indication that some relief is in sight for sulfur users was given in a recommendation of the Native Sulfur Industry Advisory committee which urged that the present 25 calendar day inventory limitation on brimstone supplies be raised to 60 days. The report stated that the difference between authorized consumption and actual consumption was 123,000 long tons of elemental sulfur for the first six months of 1952. The shortfall, as it is called, was caused in part by the recent steel strike, and a slight increase in the production of Frasch-mined and recovered elemental sulfur.

A rebuttal to William's optimistic views came almost immediately from Paul Nachtman, president of Mexican Gulf Sulphur Co.

Nachtman, whose glasses are less rose colored, said "sulfur still is in critical short supply in the United States and in the free world and will continue to be a problem chemical until at least 1955."

He added that after 1955 "increased United States and Mexican production will alleviate but hardly cure the shortage. It threatens a continuing and vexing problem that will challenge every ingenuity in its solution."

Why this vast difference of opinion?

Recent news articles give support in part to both views. It is true that the steel strike helped greatly to let sulfur supplies catch up to manufacturers' needs for sulfuric acid. In addition, the severely depressed textile industry, normally a big consumer of the acid, has not been using as much during the past few months.

The figures are encouraging. At the end of August, industry stockpiles had reached pre-Korea levels. Stocks were up to 3,019,000 tons, as compared with 2,978,000 tons in July, 1950. That was a big increase over the low-point in sulfur reserves—2,725,000 tons —in January of this year.

But government officials caution industry members to be conservative in their outlook toward the shortage. They advised industry to await completion of government studies before altering their production plans and they stressed the fact that Williams' report was just the estimate of a single company.

In summary, it looks as though the sulfur situation has improved tremendously in recent months.

Part of the improvement may be credited to judicious economies by plants in the use of the chemical, and part to strikes and business slumps. But the latter relief is not real and cannot be counted on in the future.

What can be counted on for a positive solution to the world-wide sulfur shortage are the alternate methods being developed by industry. These include production from gases containing hydrogen sulfide, use of pyrites and gypsum, recovery from sour natural gases and refinery gases and from other sources.

In addition, sulfur is being obtained by the traditional Frasch process from newly located brimstone deposits in the gulf areas. Further help will come as foreign production is increased through U. S. aid and this country's exports can be reduced.

The industry would be wise not to count on temporary economic conditions as the solution to the sulfur shortage. The real solution lies in continued conservation of existing supplies while alternate methods of obtaining sulfur are rushed forward. Industry leaders have decried the unfavorable economic conditions which have hindered the latter methods but by continued progress in this field a positive solution soon may be obtained to the critical sulfur shortage which has such a far-reaching effect on our nation's economy.

—HAMILTON C. CARSON

farm chemicals outlook

Report from Washington
by Fred Bailey & John Harms

New laws resulting from the controversial Delaney committee report are not expected by Washington officials until 1954 . . . at the earliest. The minority report, filed by Reps. Abernethy and Horan, points to considerable opposition to any change in present laws concerning use of chemicals in and on foods.

Recommendation that Food & Drug Administration have power to require prior approval of chemicals to be used in and on foods is termed "alarmist" by the dissenters. Prolonged fight is expected during much of 1953 . . . after proposed laws are introduced early next session.

Industry observers generally are uneasy about what laws might come of the report . . . but say committee recommendations are not as strong as was feared earlier.

Abernethy and Horan say adequate legal facilities already exist for full protection of consumers . . . new procedures would unduly delay the use of new chemicals as insecticides.

Nitrogen fertilizer production expansion program very likely has been pushed back as much as one year by steel work stoppage, officials here believe. Actually, however, these same officials expect that nitrogen fertilizer supplies this year may be somewhat greater than was thought earlier.

Special attention is being asked by USDA for the fertilizer industry in its claimant functions before allocating agencies. Efforts are being made to break DPA policy which is concerning itself solely with military needs. Opinion here is that a break in this hard policy must be made in some areas . . . and fertilizer production is one of critical need.

Critical anhydrous ammonia storage situation is recognized by officials here. Production capacity is rising, so is demand . . . but shortage of pressure tanks is seen as limiting factor in increased supplies. Quality steel plate needed for pressure tanks also is needed by the military.

Loss in production of by-product ammonia is viewed in official circles as not too important in the over-all picture. This is based on a belief that losses in some areas will be made up rapidly by production increases elsewhere.

Program determination to set goal for phosphatic fertilizer production is to be in line with requirements outlined by USDA. The goal for 1955 is about 1.4 million tons over 1950-51 production. Accelerated tax write-offs are planned specially for implementation of non-sulfur methods.

Government's fertilizer "sales program" is getting slow start because of drought and animal disease emergencies. Men deep in sales program also are involved in other programs . . . considered to have priority.

But USDA fertilizer men are anxious to get started. Meeting of steering committee, made up of all interested USDA agencies, was planned for late August . . . after one postponement.

Extension Service, Experiment Stations and Agricultural Mobilization committee system are to carry load of drive. It is to be incorporated with the agricultural conservation program. County ACP meetings this fall will preach more fertilizer use and efficiency.

A USDA handbook on fertilizer utilization is being prepared . . . for distribu-

tion to fieldmen in contact with farmers. It will stress translation of general principles to specifics . . . facts of local significance to individual farmers.

Sluggish farm buying of pesticides for the 1953 season is forecast by farmers' experience this year, Washington officials say.

A fairly light insect season in early 1952, plus the big July drought has left considerable unused pesticides on farms and in the hands of dealers, these officials say. They also note a marked drop in fertilizer sales nationally.

USDA is planning a more intensive drive to get farmers to buy at least minimum quantities which they might need next year. Stress again will be on early buying. Officials recognize that farmers may think the government has been crying wolf too often. It'll take a big sales job to convince farmers they should be prepared.

A ceiling price increase is in the works for mixed fertilizer manufacturers. It's to come as relief from higher freight rates effective last spring.

Under proposal, OPS very likely will permit manufacturers to add the freight increases as they come along during delivery to buyers. Observers here say OPS policy is to allow boosts in transportation costs added to outbound shipments only.

FTC probe of advertising claims for soil conditioners very probably will result in some rough-stuff . . . primarily on market carpet-baggers. All soil conditioners are under regulators' eye . . . all will get the test.

Upshot of FTC crack-down will be beneficial to legitimate conditioners, industry observers here believe. Hope is that move is not too late . . . that too many users have not been bitten by unscrupulous advertising to turn opinion against all.

States themselves are beginning to crack down. One conditioner has been ordered off the market in Virginia . . . other states may follow this lead.

FTC is reported turning its attention to "extravagant" claims made for some fertilizers. We are informed that the watch-dog agency is getting ready to lower the boom on claims that some types of fertilizers have everything: all the elements needed by crops.

Farm programs are not to change with a change of men in power . . . whether Republicans or Democrats. That's opinion of farm leaders here. Farmers are to continue to receive production and marketing help from government . . . no matter who gets in.

Democrats are pledged to support major storable crops at 90 per cent parity or higher through USDA programs. Republicans, more vague in methods, say farmers ought to have 100 per cent parity "in the market place". Platform attention to farmers indicates party belief in a stable agriculture and government help where necessary.

It means support of high buying power for farmers . . . continuation of the farmers' position to buy fertilizers, pesticides and other production goods.

USDA production goals for 1953 again will stress big output of corn, other feed grains and pasture. A six-million acre cut in the proposed wheat goal indicates this. Most of the cut will be asked to go into livestock-supporting crops. This means more side-dressing of corn, more need for other fertilizer techniques.

New twist for 1953: Goals for grasslands. Government men on county levels are asked to draw up goals for improvement of grasslands in their areas. Whatever was done this year, farmers will be asked to do more next.

Grasslands are to be divided into three broad types: Hay and pasture land other than range land, range land, and land which should grow cover and soil-building crops. Suggestions for increasing output of forage and roughage include: use of lime and fertilizer, use of proper grass and legumes, etc.

The Paley Report, "Resources for Freedom" . . . is not dead . . . at least for the time being. The White House has directed all government agencies to find ways and means by which the 70-odd recommendations of the report can be implemented.

Industry will be brought in later for its recommendations, it is understood here.

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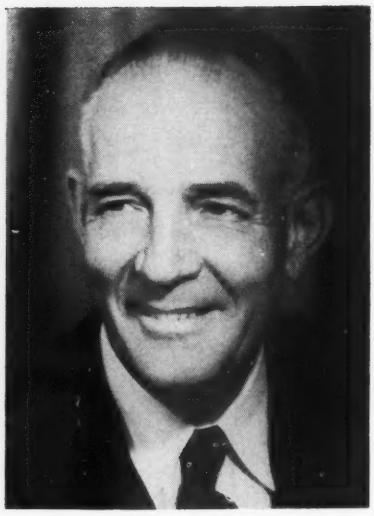


Arthur W. Mohr

19th annual meeting ***Sept. 3-5***

NACA at Spring Lake

As the National Agricultural Chemicals Association convenes at Spring Lake, N. J. for its 19th annual meeting, the gathering shapes up as the most important meeting of the group.

Here's why:

1. Attendance records for fall meetings of the organization probably will be shattered by the huge number of delegates which at FARM CHEMICALS press time had been signed up to attend the meettings Sept. 3, 4 and 5 in the Essex and Sussex Hotel. Registration was so high, in fact, that many delegates were being given accommodations in the nearby Monmouth Hotel after the Essex and Sussex reached its capacity. Last year's record of 425 seemed certain to be broken.

2. Outstanding speakers from government and industry are scheduled to speak at the meeting, with a panel of experts in the pesticide field highlighting the program.

Industry Growth

3. Rapid growth of the pesticide industry (which has been snowballing since development of organic chemicals several years ago) and widespread recognition that pest control chemicals are necessary to help produce record crop yields for an expanding economy have brought with them divergent problems and growing pains that need airing by the industry as a whole.

The advance program lists election of the board of directors as first order of business when the convention opens Wednesday, Sept. 3.

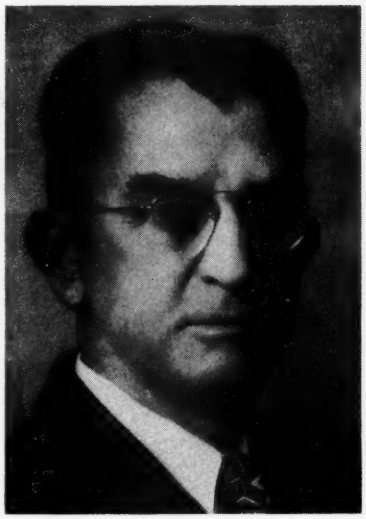
The president's address will be given by Arthur W. Mohr, president of California Spray-Chemical Corp., Richmond, Calif.

Paul Mayfield, vice president of NACA and general manager of Naval Stores Dept., Hercules Powder Co., will preside over the session, which will include an important group of speakers.

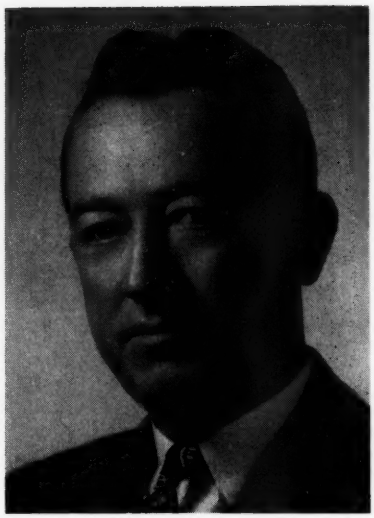
"Medical Problems in Airplane Dusting and Spraying" is the topic of a talk to be given by Dr. Clair R. Spealman, chief of the Safety Projects Branch, Civil Aeronautics Administration.

W. A. Minor, assistant to the secretary of agriculture, will discuss the problem of maintaining our high standard of living as the population increases and available cropland remains static in an address entitled "Food for the Fifth Plate."

Minor will be followed on the program by Dr. O. D. Humphreys,



Avery S. Hoyt



Dr. Paul D. Sanders

president of the University of Wyoming, who will talk on "Investment in Progress."

The morning session will be concluded by a commentary on "Agriculture's Role In the American Story," to be given by Dr. Paul Sanders, editor of Southern Planter and a widely known expert on the agricultural scene.

Vital information on domestic pesticide requirements for the 1953 season will be given delegates at the morning session on Thursday, which will be presided over by President Mohr. Discussing the requirements will be Dr. H. H. Shepard, staff specialist, Office of Materials and Facilities, PMA, USDA.

Role of Agriculture

Dr. Oris V. Wells, chief of the Bureau of Agricultural Economics, USDA, will speak on "Agriculture and Technological Improvements," and W. W. Dykstra, will talk on "Conservation Programs and Pesticides."

Dykstra is assistant to the chief, Branch of Predator and Rodent Control, Fish and Wildlife Service, Department of the Interior.

The session will close with an address by Gene Flack, sales council and director of advertising, Sunshine Biscuits, Inc.

A golf tournament, entertainment for ladies and bathing in the Atlantic Ocean (just a beach ball's throw from the hotel) will highlight a program of recreation in the afternoon, to be followed by the annual banquet at 7 p.m. and the board of directors meeting.

Hitchner To Report

The convention will hear a report from Lea S. Hitchner, executive secretary of the NACA at the opening of Friday's meeting.

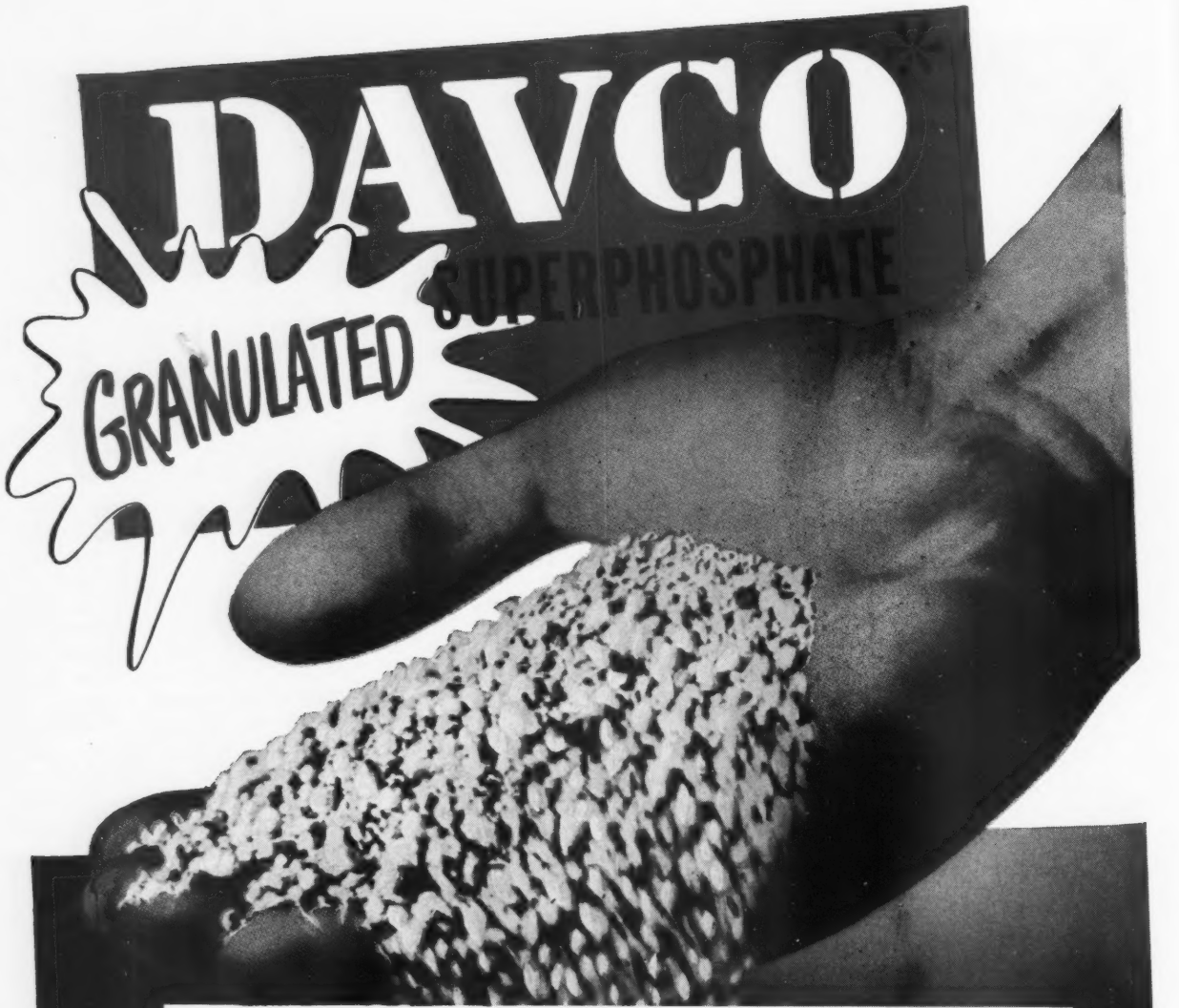
Activities of Bureau of Entomology and Plant Quarantine in 1952 will be summarized by Avery S. Hoyt, chief of the BEPQ.

The all-important problem of pesticide residues will receive further discussion by another expert in the field, Dr. George C. Decker, head of the section of economic entomology, State Natural History Survey Division, College of Agriculture, University of Illinois.

Panel of Experts

The convention will conclude with the panel of experts, with Wallace Moreland presiding. On the program will be the following: Richard L. Davis, president of Pennsylvania Salt International Corp.; Earl R. Beckner, chief of Chemicals and Semi-Manufactured Products Branch, Manufactured Products staff, Office of International Materials Policy, State Department; Phillip H. Groggins, chief of the Agricultural Chemicals Section, Chemicals Division, National Production Authority and Dr. Ralph Stewart, director of the Agricultural Products Division, Office of International Trade, both of the Department of Commerce. ◆

View of Essex and Sussex Hotel, Spring Lake, N. J., scene of convention.



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Some answers to

Fertilizer Mixing Problems

By V. Sauchelli and R. P. Taylor

Davison Chemical Corp.

HISTORICALLY speaking, the rate of change in practice and use of products for the manufacture of plant food materials has, until recently, been traditionally slow. Even today, fertilizers are being sold with the alleged virtue that they carry essential food nutrients in organic combinations only as did the original types used a century ago. Perhaps the reason for this lies in the conservatism of agriculture itself.

The first step leading to the incorporation of chemical practices by the industry was made shortly after the chamber process for sulfuric acid manufacture became a practical reality. This led to the treatment of bones, coprolites and other mineral phosphates with acid for the purpose of increasing the rate of availability of the contained phosphorus.

This same acid also was used to fix ammonia from illuminating gas production in the form of sulfate, a product which quickly found its way into mixed fertilizers. About that time potassium was established as an essential nutrient element, and the crude salts, first mined in Germany, were used as the source of the element.

Thus, more than 80 years ago, necessary ingredients for an inorganic plant food mixture were available and some offerings of such a combination were made commercially: If proof were needed, it is to be found in a complaint registered in print in 1872, to the effect that such a material was too badly caked to be of much use as a fertilizer.[1]

Gradually, as the industry progressed, other materials were developed, particularly new sources of nitrogen, including nitrate of soda and calcium cyanamide. New and abundant sources of phosphorus became available with the discovery of phosphate rock deposits in South Carolina and Florida shortly after the Civil War. Improvements in the recovery of potash in the form of high grade muriate greatly advanced the mixed fertilizer industry. By the turn of the century it was firmly established in this country.

Animal tankages predominated as sources of nitrogen although seed pomaces were being recognized also as good sources. With development of the by-product coke oven, larger quantities of ammonium sulfate became available. Next appeared synthetic anhydrous ammonia and nitric acid derived from it during World War I. This source was destined to develop as the fastest growing source of the element. Synthetic urea was a later arrival and it provided a still different type in that it is considered an organic-type nitrogen. These synthetic materials were independent products. That is, they were produced as such and not as a by-product from some other industry.

Another significant development was triple superphosphate whose phosphoric acid was obtained either by the so-called "wet" process or by the blast furnace and electric furnace methods.

In the field of potash sources the industry developed means by which to concentrate the salt to nearly maximum theoretical values and as new sources developed other salts than muriate were made available to fertilizer manufacturers.

Chemical developments provided all the materials necessary for producing completely inorganic fertilizers but such a type was slow to appear, principally because of the difficulty in getting mixtures which would not cake during storage. Most of the nitrogen now used is inorganic. Mehring[2] has shown that in 1900 only nine per cent of the nitrogen was derived from inorganic sources. By 1949 this percentage had risen to approximately 90. Of the remaining 10 per cent less than half is from natural water-insoluble organics.

Another significant change was the increase of the total plant food content of commercial mixtures. The national average in the early twenties was approximately 14 per cent. Now, the average content is approximately 22 units.

Unfortunately no statistical record has been kept of the anticaking properties of fertilizers during this transition period but it is safe to infer that at least a fairly good mechanical condition was maintained or consumption would not have continued to increase.

During the same period American farms were being mechanized steadily so that now nearly all

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* *Paper presented at meeting of American Chemical Society, Division of Fertilizer Chemistry, held in New York City, Sept. 6 and 7, 1951.*

plant foods are applied by machines, which makes it necessary that physical properties be kept within the limits that can be handled by such equipment.

It isn't enough that the requisite chemical elements be present in the proper proportionate amounts in a plant food. Unless they can be placed in the optimum location, their full value can not be utilized. Major controlling factor in distribution is uniform flow through the fertilizer applicator. This assures a constant supply in the feed mechanism of the distributor. Flowability depends on the degree of friction between particles in motion; hence a relatively constant particle shape, size and density should be maintained to insure minimum friction which permits uniform placement by the fertilizer drill.

Good Equipment

All the reasonably well designed manufacturing equipment which has been installed in fertilizer plants in the past 30 to 40 years is capable of making a material satisfactory for use at the time it is processed. But it is difficult to maintain this characteristic throughout the period required for the fertilizer mixture's passage through the subsequent stages, such as shipping, warehousing and storage on the farm until needed.

Reason for this is that a change takes place, or tends to develop which causes it to aggregate or "cake."

Fundamentally, caking develops as a result of new crystal bonds forming between the various solid particles. Water is the solvent and it provides the medium in which this action takes place.

One may ask, "Why have the moisture present?" The presence of a liquid in a dusty material seems somewhat out of order but Rader[3] has not only established the presence of such liquid films, but has investigated also some of their characteristics. This liquid comprises a solution of the various soluble salts in the solid mixture: it is not just simple water. Saturation of the liquid exists, although composition will vary with the raw materials.

A mixture having the ratio 5–10–4 may have a widely differing liquid phase composition and properties depending on the source of the nitrogen: whether as sulfate of ammonia or as a complex of anhydrous ammonia and ammonium sulfate and nitrate, or nitrate of soda and urea. So many soluble ions may be present that most data referring to single salt solubility will not apply to these multiple ion concentrations.

A wide variation in volume can exist even with the presence of the same amount of water. The equilibrium vapor pressures also differ greatly. These considerations and others indicate the reasons for studying each mixture as an entity with reference to its liquid phase.

With such a solution medium existing in a saturated state it is inevitable that some changes in the combined liquid-solid mixture should occur. With the possible exception of calcium sulfate all the predominating compounds commonly present have an increasing solubility with each increase in temperature. Up till now, we have no means of controlling generally, either temperature or humidity of unconfined spaces, so that it is necessary to accept the weather as it develops.

As temperatures of the atmosphere surrounding the exterior of a fertilizer package vary, so will the interior thermal levels vary to some degree, as will the salt content of the liquid phase. If the mass cools the saturated solution becomes supersaturated, forcing it to return to the solid phase some of the dissolved salt. This is one of the ways by which caking develops.

Good plant practice always attempts to permit as complete a chemical reaction as possible to proceed in a base pile, with concurrent or subsequent removal of as much of the heat of reaction as possible. It is the rule that a mixture should be thoroughly cool before it is bagged.

Although temperature change is the most common cause of caking the same result can occur under isothermal conditions. Egli[4] has reviewed a number of the more prominent features of crystal growth including the not-too-well understood apparent increased solution pressure of small crystals with respect to larger ones of the same type. He cites rates of growth of more than an inch per month. Happily, these rapidly increasing dimensions do not occur in the fertilizer compounds.

Having located the chief source of trouble and established its caking effects, it is now appropriate to consider the remedy. At present, two practices are followed: (1) "conditioning," and (2) "granulation." Development of conditioning was gradual, occurring almost unconsciously, while granulation was a new process which involved new equipment and a new technology.

Conditioning Fertilizers

A conditioning agent, as known in fertilizer manufacture, can be defined as a material added to a mixed fertilizer to prevent caking. Mehring has reported on nitrogen sources and particularly the shift from 90 per cent organic (natural) in 1900 to less than five per cent in 1949.

Natural organics are materials which have low enough solubilities and proper fiber composition to be considered non-caking except under pressures higher than are encountered in the industry. It is obvious that if a mixture contains a large volume of such materials it will overcome the tendency of the remainder to be consolidated by crystal bonds. Furthermore, most of these materials carry some residual oil or fat traces which are more or less water repellent. If any bond is established, it is of such a weak nature that the physical movements normal to handling and filling of the fertilizer drill are enough to return the mixture to its original free particle sizes.

Considerable confusion is apparent because of the use of conditioning materials. Often they are represented to be merely inert fillers, and as such, are unnecessary diluents. These ideas are for the most part proposed by people who are unacquainted with the caking characteristics of many plant food combinations. Fillers are used as make-weight to adjust analysis of a mixture to the even guaranteed plant food content to meet state requirements.

The materials with conditioning

properties most commonly used are oil cakes and meals from oil seeds, such as cotton, castor, soybean and similar oil plants, which because of local surplus stocks or of toxic characteristics, are not acceptable for livestock feeds. Similarly, animal tankages can be used although these at present are directed almost entirely to animal feeds. Sewage tankage has considerable conditioning effect and is quite readily obtained if fair-sized municipalities are not too far distant to make cost prohibitive. It should be noted that all of these materials carry also some plant food values.

Other materials which do not carry plant nutrients also are utilized to some extent, such as infusorial earth and some of the clays. Carbon black and powdered coal also have a conditioning effect although they are used mainly for the color effects that seem to be required to break down sales resistance in a few local areas in the country. The last class of materials appears to function as coating agents which impede solution flow. Clays and infusorial earth when dried before use have some desiccant effect and will remove some of the water in the film.

Coating Treatments

Reference has been made to coating treatments, in which fertilizer is treated during the mixing operation. Still another type of coating is used which is really a pretreatment of some of the ingredients. Coated ammonium nitrate has received so much publicity lately that it should not need mentioning, except to note that the treatment to prevent caking and deliquescence as a single material, still carries through with the material in the mixture.

Some other raw materials are partly receiving an anticaking coating, muriate of potash, for example. Taggart[5] lists a series of reagents which will develop sufficient coating to permit froth flotation from brines. Because this is a separation involving preferential wetting, these coatings should have some anticaking properties.

Most pulverized-type fertilizers still rely on the organic meals as conditioners. At least one hundred pounds per ton are used as a minimum amount, or five per cent of the weight. Because the trend in plant food units per ton is upward this conditioner is replacing intermediate material with a higher percentage of nutrients. Its presence is needed for its conditioning value and its use has to be compensated with more expensive, high-analysis carriers of plant foods.

Granular fertilizers have been developed to the commercial stage in the past 15 years. As a class, they need no conditioner, because their particle shape and size as well as the drying treatment they receive renders them non-caking. Basic physical difference between pulverized and granular mixtures is one of particle size, with the number of inter-particle contacts greatly reduced as the granules become coarser. Consequently, fewer bridges between crystals develop.

In general, because the coarser masses are spherical in shape, crystal faces are not present to cause flat solid junctions; only point contacts exist. Graton and Fraser[6] and Martin, Monrad, and McCabe[7] have reviewed the possible free volumes and areas in packed spherical systems, and a review of their studies gives the reasons why strong bonding and caking can not occur except under conditions drastic enough to destroy the shape.

Most granular fertilizers now offered are dried to moisture levels considerably lower than pulverized mixtures, hence the amount of the liquid phase is decreased and potential trouble from this effect is proportionately reduced.

British Method

The industry in Great Britain apparently has been quicker to realize advantages of the coarser particles than in the United States, for already approximately three quarters of their fertilizers are granulated. Undoubtedly sound economic reasons exist for such a situation.

In the light of the trend in raw materials and the emphasis on high-analysis fertilizers, it is very important that sound forward thinking be given to the physical properties of future plant foods. Callister[8] has very recently pointed out a great significant change in the world supply of nitrogen carriers. In the last 12 years, world production of ammonium sulfate has increased about 10 per cent, while the amount of other nitrogen compounds has doubled. Ammonium nitrate is among the big increases. In view of the present and possibly future world shortage of sulfur, it is most unlikely that much additional synthetic ammonium sufate will be produced: the economics seem to favor other and higher analysis nitrogen carriers.

Use Rock Phosphate

A possible further change stimulated by the sulfur situation is the acidulation of rock phosphate, at least in part, with nitric acid. This can become a major development. When this occurs the industry also will have to face the problem of calcium nitrate in the product. This nitrate has more deliquescent properties than does the corresponding ammonium salt, and it forms less desirable reciprocal salt pairs.

Looking into probable future developments it is evident that more and more attention will be required to produce a group of plant food mixtures high in plant food content to make their transportation to wider spreading markets economical while at the same time controlling their physical and chemical properties despite the introduction of more difficultly manageable raw materials. ◆

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Influence of chemical nutrients on the crop producing power of—

Soil Horizons

By J. B. Hester, F. A. Shelton, and R. L. Isaacs, Jr.*

IN 1930, at Rutgers University, soil investigations were initiated on the fundamental aspects of the influence of the soil reaction (*p*H), isolectric point, and silica-sesquioxide ratio of the clay component of several soils (Sharkey, Sassafras, Nipe) on the solubility of iron, manganese and aluminum as well as the influence of these elements on crop growth (2, 10, 11, 12). This study was extended in Virginia during the next five years in pot culture work using the Portsmouth, Bladen and Norfolk soils (3, 4, 5, 7).

Major Plant Nutrients

The study was extended to include major plant nutrients as well as minor and trace elements. This work has been pursued intermittently since that time with major soil groups (6, 8, 9) transported to Riverton, N. J., from Canada, Georgia, the Middle West and other areas. These investigations have been designed to ascertain the fundamental deficiencies and the contributions of the various horizons of the soil profile. This makes it possible for a practical treatment of each profile for maximum crop production.

It is well known that various horizons of the soil contribute different attributes toward crop

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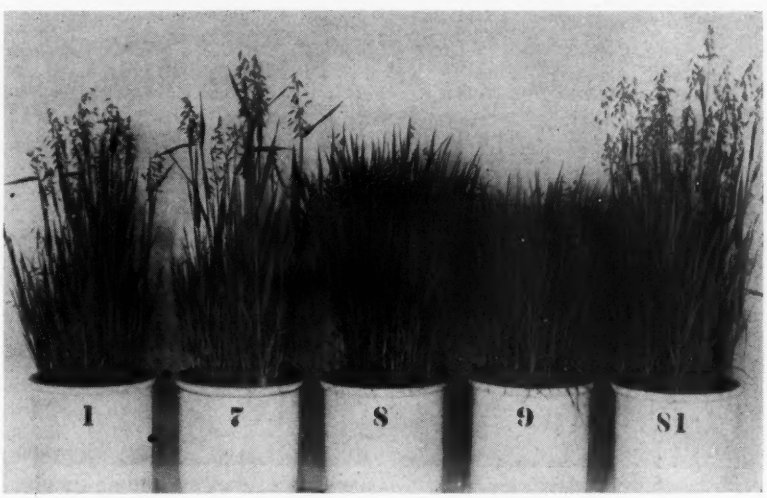
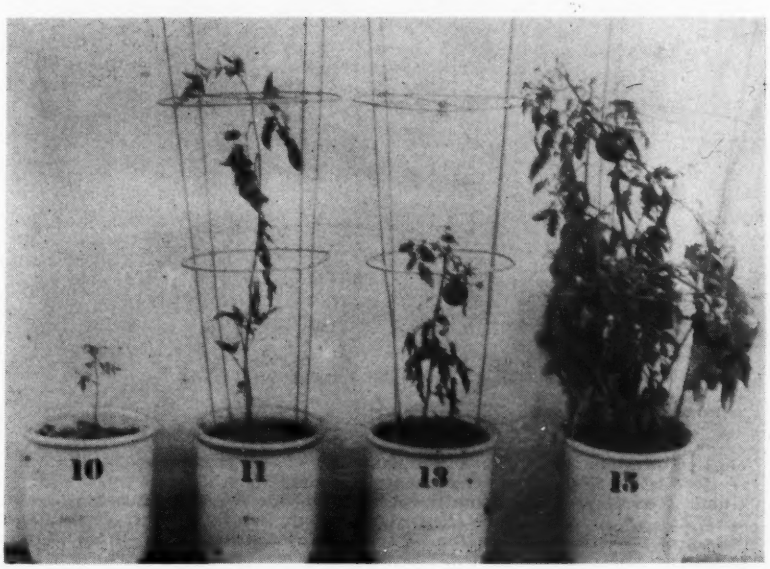
Top: Oats produced on A_p horizon. Pot 1—no treatment, 7—no nitrogen; 8—no phosphorus; 9—no potassium; 81—complete horizon and treatment. Bottom: Influence of soil amendments upon the production of tomatoes in A horizon. Pot 10—no treatment; 11—lime; 13—fertilizer; 15—complete.





Top: Oats produced on the A horizon. Pot 10—no treatment; 96—lime; 97—fertilizer; 15—complete treatment; 81—complete profile and treatment. Middle: Tomatoes produced on the B horizon. Pot 19—no treatment; 20—lime; 22—fertilizer and trace elements; 24—complete treatment. Bottom: Oats produced on the C horizon. Pot 113—no treatment; 114—lime; 30—fertilizer; 32—complete treatment; 81—complete profile and treatment.

production. One horizon, like the A_p (plowed surface), may contribute most of the nitrogen, phosphorus and calcium while other horizons, like the B and C, may contribute the major portion of the water holding capacity of the soil and such nutrients as potassium and magnesium.

This article is concerned with a study conducted on an Elkton fine sandy loam (1). The Elkton is an imperfectly drained soil and is used primarily for field crop production. However, much of it is planted to tomatoes and other vegetable crops. The Elkton series has a gray to whitish gray surface soil underlain at various depths with a mottled yellow and bluish-gray loam to silty loam, passing into the C horizon with a somewhat reddish-yellow mottled sandy loam.

The particular soil under investigation is located at Cinnaminson, N. J. In its native state it supports a luxurious growth of beech, birch, sweet gum, oak, maple and dogwood. This soil is shallow, however, and many of the trees, after becoming relatively large, are uprooted because of the shallow root system. A field adjoining the particular location concerned has been used to produce tomatoes, cabbage, cauliflower, parsley and general farm crops. The 27-acre field has only one major underground tile drain. In 1951, 18.5 tons of tomatoes per acre were produced.

The Soil Profile

A hole was dug in this soil approximately five by five feet and three feet deep. Table 1 shows the general physical characteristics of the soil.

Soil was removed from each layer and placed in three-gallon coffee-urn-liner glazed pots for greenhouse study. It is obvious from the information given in Table 1 that this soil has the capacity of retaining considerable moisture, particularly at the lower depths. The mottled condition in the B horizon, however, indicates imperfectly drained conditions with a poor capacity to supply air to the roots.

The heavy, bluish-gray clay below the 36-inch depth presents somewhat of a problem in this soil because it hinders upward and downward movement of water dur-

ing periods of dry weather and heavy rainfall.

Nutrient Content of Soil

The analysis of soil as determined by the Hester extraction method, glass electrode and L & N salt bridge are shown in Table 2. It is obvious from these data that the soil is quite devoid of plant nutrients showing high ohms resistance, acid *p*H values and low nutrient content. These data show, however, an accumulation of magnesium and a relatively high potassium content in the lower depths.

Greenhouse Investigations

The pot culture work conducted in the greenhouse consisted of investigations on each horizon separately and on a percentage-wise miniature complete profile. Treatments were made by mixing thoroughly all ingredients with the entire amount of soil except in the complete profile where all materials were mixed with the A_p horizon to conform with agricultural practices. The lime amendment was sufficient to bring the *p*H of the soil to approximately 6.5 and the fertilizer used was sufficient to produce a normal crop of tomatoes under these conditions.

Treatments:

1. No treatment
2. 100 grams of dolomitic limestone
3. 20 grams of 7–7–14
4. 20 grams of 7–7–14 + trace elements (T.E.)
5. 20 grams of 7–7–14 + 100 grams limestone
6. 20 grams of 7–7–14 + T. E. + 100 grams limestone
7. 20 grams of 0–7–14 + T. E. + 100 grams limestone
8. 20 grams of 7–0–14 + T. E. + 100 grams limestone
9. 20 grams of 7–7–0 + T. E. + 100 grams limestone

The treatments were made on Sept. 12 and 13, 1951. Pots then were carefully watered to optimum moisture content and were set with Improved Garden State tomato seedlings on Sept. 18. On Jan. 26, 1952, one-half of the original fertilizer was added to the pots as a supplemental treatment. On Feb. 6, 1952, the tomatoes were harvested and the vines returned to the soil. On Feb. 16, Clinton oats were planted with no additional treatment. These were harvested June 13, 1952. The yield records of both crops are shown in Table 3. Fertilizer formulas used are given in Table 4.

Maximum yield of tomatoes on the A_p horizon was obtained with 100 grams of dolomitic limestone and a complete 7–7–14 fertilizer with trace elements. The maximum yield of oats was with complete fertilizer. This is probably caused by the fact that the tomatoes made poor growth because of their sensitivity to acid soil, whereas oats are not as sensitive.

In other words, more fertilizer was left in the soil where a small crop of tomatoes was produced than where a large crop was removed. Figure 1 represents growth of oats in this horizon. Nitrogen was a big factor in oat production while both nitrogen and potassium were factors in tomato production.

In the A horizon the same trend was noted. This particular layer of soil had virtually no available phosphorus and practically no growth of tomatoes was made without added phosphorus (See Fig. 2). The oats used the residual fertilizer and made better growth.

The B horizon behaved somewhat similar to the A horizon, but produced more tomatoes without potassium than the previous two horizons as shown in Figure 4. Nitrogen and phosphorus were distinct limiting factors in this horizon for both crops, as well as lime for tomatoes.

The C horizon is illustrated by Figure 5. Oats produced on these pots again were able to utilize the fertilizer under more acid conditions. Phosphorus, nitrogen and lime were limiting factors in this profile. Aluminum was less active in this profile and the detrimental activity on crop growth was less as can be seen in the yield records.

The complete profile produced about the same results as a mean of the results obtained from the individual horizons. This seems to indicate that each horizon in the soil contributes definitely to soil fertility factors and not just the horizon often cultivated and fertilized.

Table 1—Physical Characteristics of Soil Under Investigation

Horizon	Depth Inches	Water-holding Capacity Lbs. per A.	Description	Per Cent Sand	Silt	Clay
A_p	0–5	688,400	Gray fine sandy loam	55	32	13
A	5–17	1,330,400	Light whitish-gray silt loam	37	42	21
B	17–30	1,336,400	Mottled grayish-yellow clay loam	37	34	29
C	30–37	520,567	Reddish yellow sandy loam	63	20	17

Directly beneath the C horizon is a three to four inch layer of impervious bluish clay interwoven with round water-worn rocks and pebbles which grades into an orange-yellow sand and gravel.

Table 2—Chemical Analysis for Available Nutrients

Horizon	Salt Concentration Ohms Resistance	pH	Lbs. per Acre CaO	MgO	Al	% Organic Matter	NH_4	Lbs. per Acre NO_3	P_2O_5	K_2O	Mn
A_p	3100	4.5	210	13	22.4	2.75	Poor	4.7	0.75	78	0.5
A	6000	4.3	82	8	17.4	1.70	Poor	0.5	Trace	48	0.4
B	5000	4.2	58	94	16.4	0.40	Poor	0.9	Trace	31	0.4
C	3500	4.5	58	118	15.6	0.30	Poor	1.8	0.6	69	0.4

Summary

Laboratory and greenhouse investigations on different horizons of an Elkton fine sandy loam indicate that each horizon makes a definite contribution to the fertility of that soil. The A_p horizon with its high organic matter content supplies most of the nitrogen and phosphorus and a part of the calcium, potassium and magnesium. The leached portion of the A horizon supplies a very small amount of the plant nutrients other than some nitrogen, but a substantial proportion of the available water.

The B horizon supplies little nitrogen and phosphorus but substantial amounts of potassium, magnesium and water.

The C horizon supplies little nitrogen and phosphorus, but substantial amounts of potassium,

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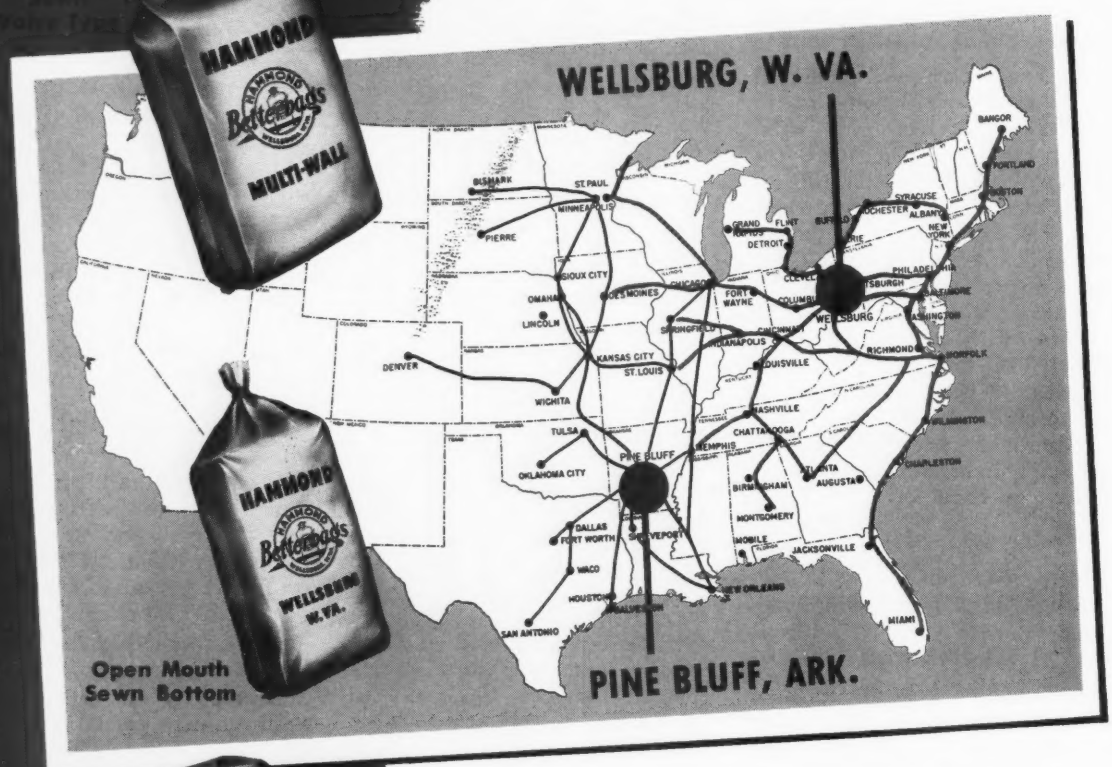

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Table 3—Yield of Tomatoes and Oats*

Treatment	A_p		A		B		C		Complete	
	Tomatoes	Oats	Tomatoes	Oats	Tomatoes	Oats	Tomatoes	Oats	Tomatoes	Oats
No treatment	55	31	0	13	0	10	0	15	0	18
Limestone	169	38	0	23	0	22	0	16	0	24
7–7–14	205	93	41	91	0	85	62	80	75	92
7–7–14 + T. E.	256	74	55	94	28	97	40	89	77	93
Limestone + 7–7–14	557	64	762	61	753	64	510	55	746	66
Limestone + 7–7–14 + T. E.	686	65	812	54	713	66	571	57	498	77
Limestone + 0–7–14 + T. E.	516	40	185	18	48	17	52	15	269	18
Limestone + 7–0–14 + T. E.	157	66	0	73	0	36	0	38	0	62
Limestone + 7–7–0 + T. E.	365	51	157	25	463	50	365	53	261	56

*Mean grams per pot—Fresh weight of tomatoes and dry weight of oats.

Table 4—Fertilizer Formulas

Materials	7–7–14	7–7–14 + T. E.	0–7–14 + T. E.	7–0–14 + T. E.	7–7–0 + T. E.
Calcium phosphate, mono	250	250	250	—	250
Muriate of potash	445	445	445	445	—
Urea	100	100	—	100	100
Ammonium nitrate	250	250	—	250	250
Ammonium sulfate	100	100	—	100	100
Dolomite	200	200	200	200	200
Magnesium sulfate	100	100	100	100	100
Sand	555	515	965	765	960
Borax	—	10	10	10	10
Manganese sulfate	—	10	10	10	10
Copper sulfate	—	5	5	5	5
Ferrous ammonium sulfate	—	5	5	5	5
Zinc sulfate	—	5	5	5	5
Molybdic acid	—	3	3	3	3
Cobalt chloride	—	2	2	2	2

magnesium and water. However, so little free oxygen is present in this horizon that the nutrients and water may be of comparatively little use to the plant. The complete profile indicates that soil fertility is dependent upon all soil horizons and each soil horizon can be influenced favorably by chemicals and soil amendments for maximum crop production. ◆

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Trade Office Sets Quota For Pesticide Exports

Available for export are 37,500,000 pounds of agricultural insecticides and fungicides containing 20 per cent or more sulfur under a new supplemental quota established for the second quarter by the Office of International Trade. Including this additional quantity, the second-quarter export quota for these commodities now totals 65,500,000 pounds.

Conditioned sulfur, wettable sulfur and sulfur paste account for 4,000,000 pounds of the quota, the remaining 33,500,000 pounds covering formulations of benzene hexachloride, DDT, lime sulfur and other sulfur formulations.

The additional quantity has been made available to friendly countries to enable them to protect their crops and thereby stimulate food production. This action is possible because seasonal domestic demand for insecticides and fungicides containing 20 per cent or more sulfur has been lower than was anticipated, and producers' stocks have accumulated in excess of domestic requirements.

1000 pounds of 10-10-10 plowed down nearly doubles corn and potato yields for Leon Epler,

NORTHUMBERLAND, PA.

● Until 1948, Leon Epler of Northumberland, Pa., was getting corn yields of 40 to 50 bushels per acre by using approximately 250 pounds of row fertilizer. But that year he began plowing down 1000 pounds of 10-10-10 in addition to the row fertilizer. His yield jumped to 70-75 bushels per acre.

He climaxed this outstanding production in 1950 with a plot that yielded 122.1 bushels per acre in the Five Acre Corn Club contest sponsored by the Pennsylvania Crop Improvement Association. The special fertilizing program used on this plot included 10-10-10.

Plowing under 800-1000 pounds of 10-10-10 gave Mr. Epler equally outstanding results on potatoes. His average yield jumped from 300-350 bushels per acre to 500-550 bushels. Improved spraying and cultural methods also played a role in this increase.

Bigger yields for farmers mean better business for you

● On all types of crops, high-nitrogen complete fertilizers are paying for themselves over and over through higher quantity and better quality yields.

Every bumper crop produced by high-nitrogen fertilizers increases the demand for these products. And now is the time for you to cash in on this demand by putting heavy promotional effort behind the high-nitrogen fertilizers in your line.

When you use U·S·S Ammonium Sulphate in your mixed fertilizers, you'll find the selling job easier. Farmers know the name "United States Steel" stands for top quality. Many of them have used U·S·S Ammonium Sulphate as a straight-nitrogen material . . . they know it's dry and free-running . . . they know it won't set up in storage and that it handles well in distributing equipment.

For complete details on U·S·S Ammonium Sulphate contact our nearest Coal Chemical Sales Office or write directly to United States Steel Company, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

U·S·S AMMONIUM SULPHATE

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UNITED STATES STEEL

A neglected field:

Insects as Carriers Of Plant Diseases

By W. L. Popham

THE PART INSECTS play in the transmission of plant diseases is a biological field of rapidly increasing interest to the entomologist, the plant pathologist and the plant breeder. With each passing season some new information is added to the total knowledge of the problem and we achieve a better understanding of the significance of viruses in the agricultural economy of the country.

The role of insects in the transmission of plant diseases was a long neglected field of research. It lay in a so-called "no man's land" between two important branches of biology. From the standpoint of successful control of a destructive disease, there is perhaps no phase of plant pathology more fundamentally important than that dealing with the methods by which the disease is spread from plant to plant, field to field and from one area to another. Yet few plant pathologists have devoted any great amount of effort to the study of insects in relation to the spread and development of plant diseases.

The problem has been neglected to an equal degree by entomologists who, with few exceptions, have devoted their time and effort to studying insects causing direct injury to plants. Only recently has the more complex and obscure role of insects acting as vectors of plant diseases been given anything like the attention it deserves. This is becoming increasingly evident as we understand more fully the importance of viruses in our overall plant protection effort.

One of the papers presented in a joint symposium on Insect-Transmitted Plant Diseases of the American Association of Economic Entomologists and the Entomological Society of America, Cincinnati, O., Dec. 11, 1951.

One Interest

Phytopathologists and economic entomologists have one all-important interest in common—the problem of plant protection. Workers in both fields are concerned with the protection of our agriculture from the innumerable pests which collectively take an enormous annual toll of our national production. Although this common interest exists, the two sciences have rather widely diverse interests, which may be explained to some degree by the origin of the two branches of biology.

Not so many years ago the broad field of biology was considered a highly specialized subject. It was considered possible to obtain a fair mastery of available knowledge in the field. With the passing of time knowledge in the field increased so rapidly that most investigators have come more and more to specialization. First, biology was divided into botany and zoology.

Later, each of these was divided and subdivided, each segment developing its own techniques and vocabularies, but there is a vast area in which the botanical and zoological sciences are inseparable.

Nearly 60 years ago Waite pioneered in the field of plant disease transmission by insects, showing that certain species were definitely of importance as vectors. He demonstrated that fire blight of pears could be transmitted by bees and wasps. As early as 1884, Forbes had expressed the opinion that fire blight was transmitted from tree to tree by the tarnished plant bug. Some years later, his theory was verified by Stewart.

In 30 years that followed Peter's work with the olive fly and the bacterial olive-knot disease and E. F. Smith's demonstration that curcurbit bacterial wilt was transmitted by the striped cucumber beetle, an increasing amount of interest was shown in the subject.

Summary Published

In 1920, Rand and Pierce summarized for publication existing knowledge of insect transmission of plant and animal diseases. The authors coordinated the literature in both fields. They recognized certain principles common to both. These broad principles were used as a basis for a practical classification of the known phenomena of insect transmission.

Owing, in part at least, to the interested created by this paper, the American Phytopathological Society and the American Association of Economic Entomologists held a joint symposium on "Insects as disseminators of plant diseases," at their annual meeting in Toronto in 1921.

The part played by insects in the transmission of fungus disease likewise began to receive more attention. In 1847 Leunis had sug-

gested the possibility that ergot spores were spread by insects. Sturgis in 1898 suspected that insects were responsible for the transmission of the downy mildew of lima beans.

More recently, we have had such examples as chestnut blight and the Dutch Elm disease. The former depended on insects only to a limited degree. The latter, of course, is dependent to a large degree, if not entirely, on activity of certain bark beetles. Of equal interest is the part the Ips play in spreading the fungus causing blue stain of conifers; and the relationship the wooly aphid has to the spread of perennial canker and European canker of apples.

The spread of virus diseases is more closely associated with insects than any other group of plant pathogens. Most true virus diseases of plants appear to be, at least to some extent, transmitted by insects—and there are a number that are transmitted in nature only by insects. During the past 35 years many virus diseases have been described and new ones continue to be reported with alarming frequency.

Virus Association

As we delve deeper into the complex phase of biology, we find one or more viruses associated with nearly every cultivated crop. Some are subject to attack by many different viruses as in the case of potatoes. Certain others, such as curly top of sugar beets, aster yellows and spotted wilt of tomatoes, have a wide host range among both weeds and cultivated plants. Since Takami in Japan in 1901 reached the conclusion that the dwarf disease of rice was caused by the feeding of the leaf hopper much has been learned in this important field.

Today at least 125 viruses are known to be insect transmitted. It is difficult to forecast the future. However, sufficient progress has been made to suggest that viruses constitute the biological challenge of this century.

To add complications to an already complex problem, it has been found that the transmission of viruses through seed occurs in some instances. This has been demonstrated with the common bean and certain other legumes, wild cucumber, muskmelon, potato, lettuce and tomato.

Hildebrand in 1945 and Cochran in 1946 announced evidence that viruses were transmitted through cherry seeds. About the same time pollen was incriminated. Then came Fukushi's work demonstrating that a virus could be transmitted congenitally from one insect generation to the next through the egg. Working with the leaf hopper, he succeeded in demonstrating congenital transmission for seven successive generations.

Two Factors

Two important factors are fundamental to the control of and insect-borne virus disease of plants. It is essential first to determine the vector or vectors responsible for transmission. This has proved simple in the case of some diseases, but extremely difficult in others.

To appreciate fully the complexity of the problem we need only recall the years of work that have been devoted to the study of aster yellows, peach yellows, phloem necrosis of elm, phony peach disease, tristeza disease of citrus and the quick decline of citrus. Moreover, once the mode of transmission is determined, we have reached only the half-way mark in solving the problem.

An economic and practical means of destroying the vector must be found. This frequently introduces such problems as plant tolerances and plant and soil residues, which are attracting the interest of the Food and Drug Administration—and even committees of Congress. Also, plaguing the research worker is the realization that, over a period of time, insects may develop races resistant to chemical controls now widely accepted as effective.

Shotgun Killers

Confronting the entomologists and plant pathologists is the degree to which some present-day chemicals are shotgun killers. They do not distinguish between friend and foe. For example, it is not uncommon for spider mites to become a problem following the use of DDT. Also certain species of aphids may increase rapidly following destruction of their parasites by some of the newer insecticides now in common use.

Mites may present no particular problem except the damage they themselves do. However. many aphids are commonly recognized as associated with the spread of viruses and the damage they do directly may be incidental to the role they play in the transmission of disease.

To supplement modern methods of cultural, biological and chemical control, we are coming more and more to recognize the important place that quarantines fill in preventing or delaying the spread of plant diseases and their insect vectors from one locality to another. Over the years, quarantine procedures have been developed which are highly effective in preventing introduction into this country of both plant diseases and insects.

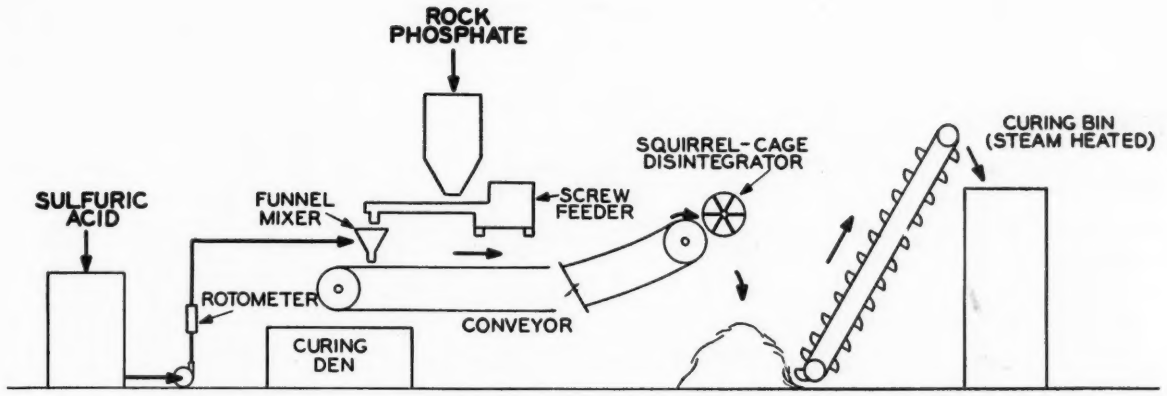
A new virus disease may be of little concern unless a vector is present to spread it. Many insects which have proved efficient vectors of disease may cause little damage by direct feeding. Viruses present a very complex problem in the enforcement of quarantine, because it is not uncommon for symptoms to be masked to the extent that they cannot be detected.

A virus of little consequence in a foreign country may find host material to its liking when introduced into this country.

Integration Needed

Agriculture is becoming more and more a highly technical enterprise, and specialization in the many branches of biology must continue. But, in our overall plant protection effort, there must be closer integration of the efforts of the plant pathologist, the entomologist, the nematologist, the chemist who deals with fungicides, insecticides and nemacides and the engineer whose task it is to develop the specialized equipment so essential in efficient pest control.

It seems to me that plant protection warrants greater emphasis in our overall agricultural planning. To reduce losses caused by crop pests certainly is a logical way to increase production without adding acreage or seriously affecting the amount of manpower and equipment devoted to agricultural pursuits. ◆



Equipment used for testing experimental continuous mixers for normal superphosphate.

For manufacture of normal super, TVA has funnel-type

Continuous Mixer

L. D. Yates and W. B. Williams

Tennessee Valley Authority
Wilson Dam, Alabama

FOR THE PAST nine years the Tennessee Valley Authority has used a simple funnel-type continuous mixer for mixing rock phosphate and phosphoric acid to produce concentrated superphosphate. As described in the literature (*1*, *2*), the mixer has no moving parts.

It consists of a cone with 75-degree sides into which finely ground rock phosphate and phosphoric acid are introduced at controlled rates. The rock phosphate drops into the center of the cone. Acid is delivered tangentially through four nozzles located on the inside surface of the cone. The acid enters at a fairly high velocity so that a swirling film forms over the lower surface of the cone. A pipe is attached to the bottom of the cone to serve as a discharge extension which prevents fluid acidulate from spraying in all directions as it is discharged.

A mixer of this type with a cone only 27 inches in height has been operated successfully in the production of concentrated superphosphate at mixing rates of from 17 to 50 tons an hour.

TVA Investigated

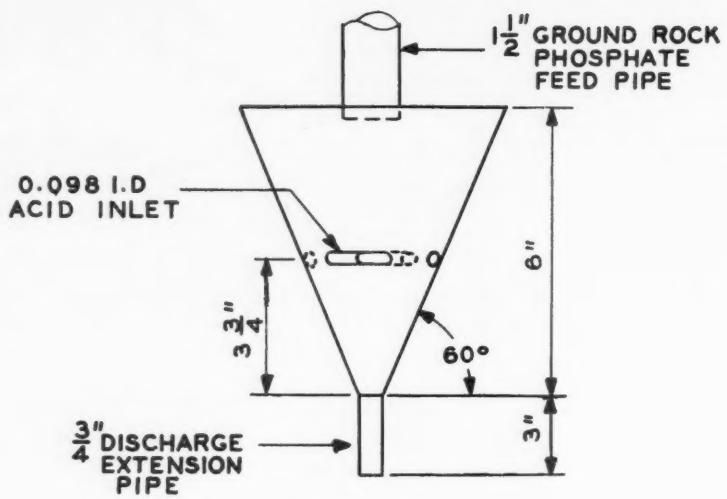
Because of the highly satisfactory performance that had been achieved with this mixer in the manufacture of concentrated superphosphate and because of its low initial and maintenance costs investigation of the feasibility of using mixers of this type in production of normal superphosphate was started.

Several experimental mixers of different design were tested. The angle of the sides of the cone, the diameter of the discharge extension and placement and number of nozzles for acid inlets were varied.

Figure 1, a sketch of the mixer with which satisfactory results were obtained in tests at a mixing rate of one ton an hour, illustrates the size of the experimental mixers.

Because the mixers were small it was more practical to weld the acid inlets into the sides of the cone rather than to introduce them from the top as is done in the plant concentrated superphosphate mixer. An exception was made in tests carried out to determine the best location for the acid inlets. In these tests portable nozzles were introduced into the mixer from the top. Acid inlets were horizontal in all mixers and were placed so that the acid was delivered to the cone tangentially. Tests were made using two or four acid inlets.

The cross section of the acid inlets was such that the acid velocity at the point of entrance



TVA funnel-type continuous mixer

into the cone was 6.5 feet a second for a superphosphate production rate of one ton an hour except with one mixer in which the velocity was 11.9 feet a second. Six and one half feet a second is the magnitude of the horizontal component of the velocity in the acid inlets from the plant mixer at a concentrated superphosphate production rate of 40 tons an hour. Discharge extensions on all mixers were three inches in length and were made either of ½- or ¾-inch pipe.

Figure 2 shows arrangement of the equipment used in the tests. Ground Florida phosphate was dropped from the feed hopper to a calibrated screw which fed it to the mixer at the desired rate. Composition and screen analysis of the phosphate used in the tests are shown in table 2.

Sulfuric acid (70 per cent H_2SO_4 and 140° F.) was pumped from the acid storage tank through a rotameter to the acid inlets of the mixer. An attempt was made to hold the acid to rock phosphate weight ratio in the range 0.80 to 0.82. This is in the lower part of the range of commercial mixing ratios, which extends from 0.77 to 0.96.

Analyses of normal superphosphates produced in the tests indicated the mixing ratio varied from 0.75 to 0.86 (95.5 to 97 per cent acidulation as determined from the nomographs of Shoeld et al. (3)). This wide variation was attributed to fluctuations in the rates at which acid and dust were delivered into the mixer.

Discharge from the mixer went onto an 18-inch conveyor belt rest-

Table 1.—Analyses of Fresh Superphosphate and Cured Superphosphate Prepared in the Mixer of Figure 1

Composition, per cent				Available P_2O_5, per cent of total	Acid-rock phosphate weight ratio[a]	Acidulation,[b] per cent
P_2O_5						
Total	C.I.	SO_3	Free H_2O			
Fresh Superphosphate Solidified in Den						
18.7	1.1	25.9	—	94.1	0.78	93.5
18.5	1.2	25.9	—	93.5	0.79	94.5
17.6	0.7	26.1	—	96.0	0.84	98.0
Pile-Cured Superphosphate[c]						
19.8	0.9	28.6	6.4	95.5	0.81	96.0
20.5	0.2	30.8	4.7	99.0	0.85	98.5
20.3	0.3	30.9	5.1	98.5	0.86	99.0

[a] Calculated from analysis; ratio 70 per cent H_2SO_4/32.2 per cent P_2O_5 rock.
[b] As defined by the nomographs of Shoeld et al. (3).
[c] Pile curing simulated using heated bins.

Composition, per cent (dry basis)							
P_2O_5	CaO	Acid insoluble	Al_2O_3	Fe_2O_3	F	CO_2	Ignition loss, %
32.2	47.2	7.6	0.9	2.0	3.5	2.5	6.1

Screen analysis, per cent, through Tyler mesh shown			
35	100	200	325
99.6	87.5	64.4	47.7

ing on troughing rolls. The conveyor could be made to travel in either direction. Under the end of the conveyor near the mixer was located a large metal box or den into which the fluid acidulate could be discharged. At the other end, 33 feet from the mixer, a squirrel-cage disintegrator was placed.

Speed of the conveyor belt was regulated so that the superphosphate would solidify while it was being conveyed to the disintegrator. Superphosphate from the disintegrator was charged into a steam-heated asphalt-lined wooden bin, 15 by 30 inches by 10 feet deep, where it was cured under conditions similar to those which exist in a large pile.

Funnel-Type Mixer

With the funnel-type mixer it was more difficult to mix rock phosphate and sulfuric acid to make normal superphosphate than it was to mix rock phosphate and phosphoric acid to make concentrated superphosphate. Concentrated superphosphate could be prepared in several of the experimental mixers of different design whereas only one design was satisfactory for making normal superphosphate. There are two reasons for this difference:

1. The weight ratio of liquid to solid in the manufacture of concentrated superphosphate when using 78 per cent H_3PO_4 electric-furnace phosphoric acid is 1.37 instead of about 0.82 as was used in the tests for the production of normal superphosphate and

2. Foaming is a more serious problem because gases are evolved more rapidly and in greater volume when rock phosphate is acidulated with sulfuric acid than when acidulated with phosphoric acid.

Mixing cones with sides at 83, 75, 60 and 45 degrees to the horizontal with two acid inlets were used in one series of tests. The acid inlets were in the lower 2½ inches of the cones except in the 83-degree cone in which inlets were near the top of the mixer.

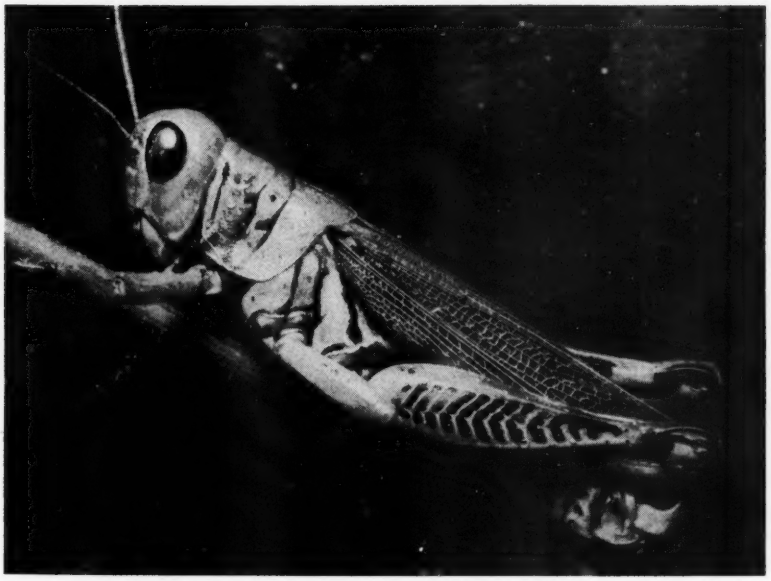
The discharge extensions were made of ½-inch pipe in all cases. Satisfactory continuous operation was not obtained with any of these mixers; a large amount of foaming took place and the mixers became plugged with dust within a few minutes. However, fairly satisfactory operation was obtained with the 60-degree cone for short periods. During these periods, the mixer operated with a layer of dust on the top of the swirling acid. Occasionally lumps of solidified superphosphate which had formed at the acid-dust interface would plug the discharge extension. Somewhat better but still not entirely satisfactory operation was obtained with a 60-degree mixer with a ¾-inch discharge extension.

Best Arrangement

The study was continued, using a 60-degree cone, to determine the best arrangement for the acid inlets. In one series of tests two portable inlets were introduced from the top. In moving these up and down in the mixer it was determined that the best operation was obtained when the inlets were 3¾ inches above the discharge extension. When the inlets were in this position, however, the acid film on the sides of the cone arched down between the inlets, leaving damp spots to which dust adhered. Eventually this adherence of partially acidulated dust formed a crust in the mixer and

(*Continued on page 69*)

Montana entomologist outlines information for gaining control of



Grasshoppers

YEAR AFTER YEAR grasshoppers are the most destructive insect pests in many western states. Montana, one of several states repeatedly plagued with the grasshopper, has done considerable research work on the problem of controlling the pest.

Pesticide industry personnel should be interested in a recent bulletin from the Office of the State Entomologist, which describes activities of the insect and outlines methods of control under various conditions and with several pest control chemicals.

As is the case in many states, there are more than 80 different species of grasshoppers present in Montana. Many of these can be of economic importance on rangeland but only a relatively few are of economic importance on cropland. In addition to the fact that there are so many different types of grasshoppers, control is complicated because different kinds of grasshoppers in many cases have different feeding and movement habits.

Take the case of croplands. One species normally lays most of its eggs in the marginal areas, making it possible to control the bugs at a minimum cost before they move into the fields. But another species commonly found in Montana croplands often lays its eggs through the fields, negating possibility of an early marginal control program.

It is far more reliable, practical and cheaper, in Montana, at least, to use sprays rather than dusts in controlling the pest. This is because sprays have greater resistance against rainfall, particularly in the case of oil sprays.

As for the method of application of the chemicals—aerial or ground—both are recommended and each has several important advantages.

Features of ground application include the following:

1. Cost per acre is less for the farmer if he owns a good spray rig than if he hires his spraying by aircraft each time it is needed.

2. Speed. If the farmer has a ground sprayer ready to use, he saves time lost in waiting for the services of an aerial sprayer.

3. Ground sprayers are adaptable to other uses than spraying for grasshopper control. Some are available which can be used also for spraying livestock at higher pressures.

Aerial Spraying

Advantages of aerial spraying:

1. Large areas can be sprayed much more rapidly than with ground equipment. This is important when flights of migratory grasshoppers move into large crop areas.

2. Versatility. It is usually possible to cover areas with aircraft which cannot be treated with ground equipment. This is the case with grasshopper infestations in gullies and other inaccessible places.

3. Air applications usually employ oil. These are more resistant to rain than are the water emulsions usually used in ground application.

4. Air application is advantageous when necessary amounts of water needed for ground application are not readily available.

Pest chemicals recommended for grasshopper control are aldrin,

toxaphene and chlordane as sprays. Dusts are not recommended. Application rates for Montana are as follows: aldrin—two ounces per acre; toxaphene—1½ pounds per acre against the young insects, two pounds per acre against mature; chlordane—one pound per acre against young; 1½ pounds per acre against adults.

The Montana bulletin stresses that neither toxaphene nor chlordane should be used on rangelands or in places where foliage is turning brown either because of drought or maturity. These chemicals have not shown effectiveness in destroying grasshoppers by contact, their principal effect being as a stomach poison. They may be used effectively against cropland grasshoppers, however, particularly for early marginal spraying or any type of spraying where green succulent foliage is present.

Ground Application

For ground application of the three pesticides mentioned, a total volume of five gallons of water or more per acre should be used. The insecticides may be applied by aircraft in one gallon of oil per acre of cropland. For control of grasshoppers on rangeland, application of two ounces of aldrin in ½ gallon of oil per acre have been successful.

Of the three chemicals recommended, the Montana bulletin points out that aldrin has several advantages over toxaphene and chlordane.

Some of the more important advantages are the following:

1. Cheaper.

2. Direct contact action against grasshoppers. While all three chemicals are potent as stomach poisons, aldrin is effective on contact with the pests.

3. Because of the direct contact action of aldrin, it can be used when properly applied on dry or mature foliage where toxaphene and chlordane have given poor control.

All three pesticides have a residual effectiveness as a stomach poison for a period of four to five days. Some instances of poor control were noted in Montana last year during periods of continued cool weather. Control was reestablished, however, when the weather became warmer.

Aldrin for Rangeland

Aldrin has been applied on rangeland at the rate of two ounces per acre where cattle were pasturing with no apparent ill effects to the cattle, but this practice is not recommended in Montana until more is known about toxicity of aldrin to livestock.

For this reason it is recommended that cattle be removed from pastures sprayed with aldrin for at least two and preferably four weeks after spraying.

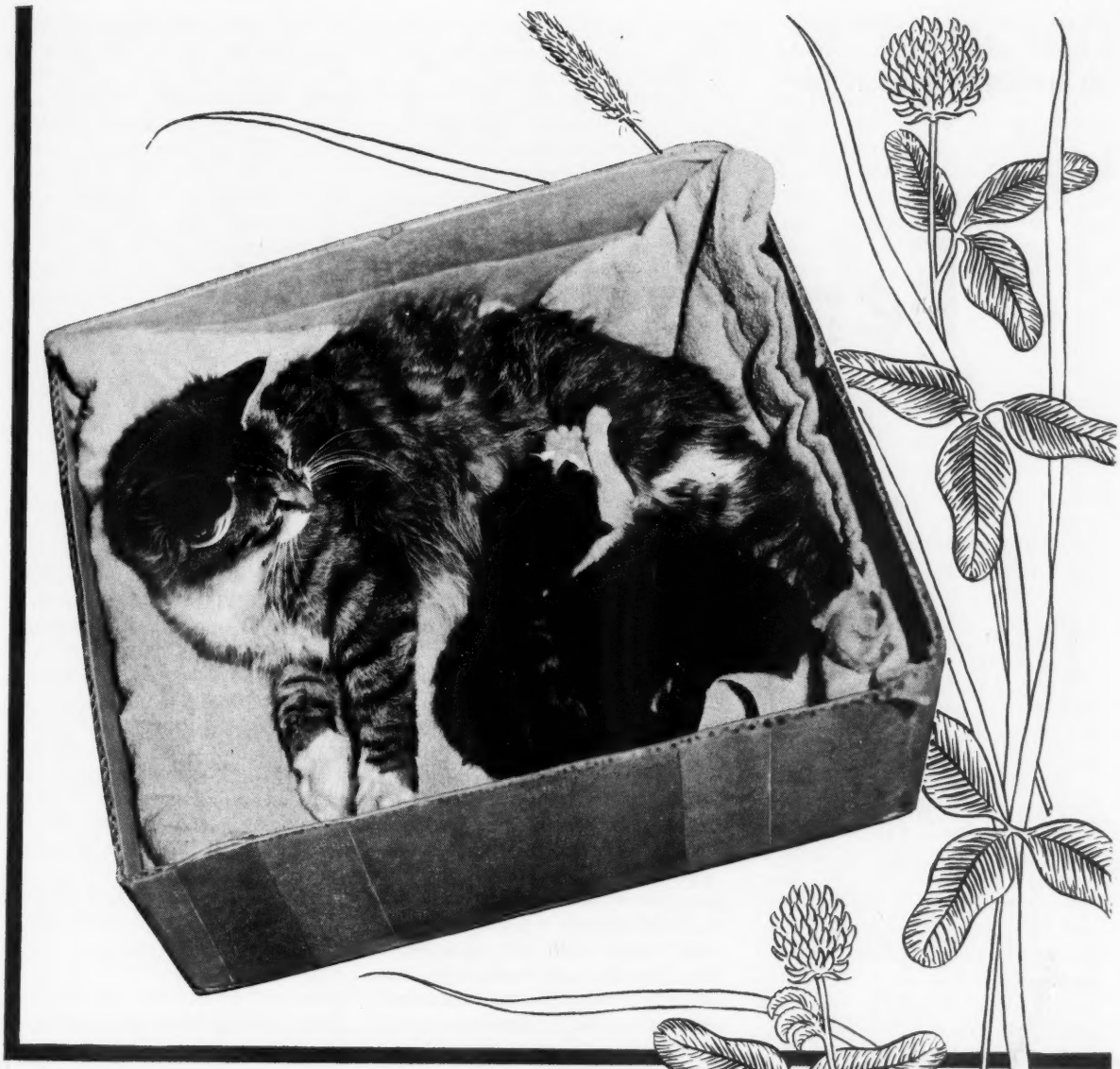
By the same token, studies conducted in Montana yielded no evidence that aldrin, toxaphene or chlordane caused death to birds and wild animals in the area but airplane applicators are cautioned not to apply the materials on rivers, creeks, lakes and reservoirs where fish may be present.

To prevent destruction of valuable honeybees, certain precautions are recommended for grasshopper control. Aldrin and chlordane are extremely toxic to bees; toxaphene to a somewhat less extent. None of the insecticides should be applied on plants which are flowering during the time of day when the bees are active. They should be applied instead early in the morning or late in the evening when the bees are not flying.

For control of grasshoppers on cropland, early marginal treatment is recommended for Montana. Most of the infestations of cropland hoppers this year involve species which habitually lay their eggs in areas marginal to the fields, according to the report. By destroying the pests in these marginal areas, a great saving can be effected in total cost of control.

The treatment should be made soon after the grasshopper hatch is completed. This time is not easy to determine, so the bulletin recommends starting the treat-

(Continued on page 62)



A WHOLE FARM THRIVES ON NOURISHMENT

Kittens or cabbages . . . sheep or alfalfa . . . growth on a farm is a relentless process.

This never-ending struggle for survival and growth is a tremendous drain on the rich plant-food elements within the soil. No matter how deviously, every living thing must look to the soil for its basic nourishment.

Nature often cannot replenish these vital soil ingredients, and fertilizers containing POTASH are used. Sunshine State Potash, a product of New Mexico, helps make such fertilizers more than a mere soil nutrient. It strengthens the crops . . . aids in effectively resisting disease and drought.

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HIGRADE MURIATE OF POTASH 62/63% K_2O
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UNITED STATES POTASH COMPANY, Incorporated, 30 Rockefeller Plaza, New York 20, N. Y.

A nationwide basis for

Fertilizer Safety

By J. S. Fields

Chairman, Fertilizer Section
National Safety Council

THE true importance of accident prevention is well recognized and something can be done to prevent accidents which will result in great human and monetary savings.

Accident prevention and taxes have one outstanding characteristic in common: Each year we realize more and more how important both of them are to us and how much they influence our business and private lives. Accidents are just as sure as taxes unless management takes a firm stand and deliberately does something real and concrete to prevent them. Management must realize the fact that the causes of accidents and the causes of operating troubles are the same. Accident prevention which embodies the control of each employee work performances, the elimination of hazardous conditions, unsafe construction and faulty methods of operation is a matter of vital importance to the continued economic stability and harmonious employee relationship of any industrial organization.

How It Started

The idea of a fertilizer safety section, if not originated, at least took concrete form during the National Safety Congress at Chicago, Ill., in October, 1950. The total absence of any program pertaining to even the manufacturer of the prime products of the fertilizer industry such as anhydrous ammonia, ammonium nitrate, nitrogen solutions, ammonium sulfate, sulfuric acid or phosphate was very apparent.

Industry Ignored

The extensive mixed fertilizer industry was not only ignored but apparently unheard of. In fact we were informed by a representative of a well known organization that most of the fertilizer other than that supplied by horses, etc., was manufactured by the meat packing companies as a by-product.

A group of men at a "bull session" decided to find out why the fertilizer industries had been ignored and attempt to do something about it. All the group in this meeting were representatives of companies primarily producing the prime products of the fertilizer industry and each company had a well organized safety and fire prevention program with annual frequency rates far below the national averages for that type manufacture. The initiation of the program was not particularly for the reason of self benefit but to benefit the entire fertilizer industry which naturally includes the producers of the prime products.

For example, Phillips Chemical Co. with a total employment of approximately 2850 persons is engaged in the manufacture of anhydrous ammonia, nitric acid, prilled ammonium nitrate, nitrogen solutions, carbon black, butadiene and synthetic rubber, sulfur, and ammonium sulfate. It had a lost-time accident frequency rate of 1.8 for the year 1950, and the frequency rate since has dropped to 0.70. After the Chicago discussion the first meeting was called in the offices of the Spencer Chemical Co. at Kansas City, Mo., on Jan. 16, 1951. The next meeting was held in the offices of Phillips Chemical Co. at Bartlesville, Okla., March 20, 1951, where the first officers were elected.

The third meeting was held at Baltimore, Maryland, with Davison Chemical Co. as host. The first Fertilizer Safety Section program in the history of the National Safety Congresses was organized for the October, 1951 meeting. The first program presented at Chicago was highly successful. A meeting of the advisory committee was held in the offices of the National Safety Council Dec. 5, 1951, at which committee chairmen were appointed and the working program of the Fertilizer Safety Section started to function.

Another First

Another first in the history of the Southern Safety Association which holds its conferences each year was the Fertilizer Safety Section meeting on March 3, 1952, at Atlanta, Ga., which was well attended and the program well received. The road this far has not been easy and has required the sincere interest and work of many. In my small part in this program I wish to express particularly my

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Presented at Fertilizer Section,
North Carolina Safety Conference
Ashville, North Carolina
May 6, 1952

sincere appreciation to past officers, members of the advisory committee chairmen, the National Safety Council, the American Plant Food Council, the National Fertilizer Association, fertilizer trade magazines and compensation and fire insurance companies whose sincere efforts and interest has made the present progress and reality of the Fertilizer Safety Section possible.

While the growth of this new section of the National Safety Council has been phenomenal we have only started and still have a long road ahead and a majority of the work of actual accomplishment is before us. The fertilizer industry in the past 20 years has grown like Topsy. Could that be the reason and if it is, could it be justified, that safety and fire prevention have been overlooked? Have each of you analyzed the true economics of such programs—we don't believe so. As you know compensation insurance rates for the manufacturers of fertilizer are among the highest in the nation, on a par almost with oil drilling operations. The rate for fertilizer is approximately six times the rate for oil refining. Do you believe that mixing and handling fertilizer products is six times as hazardous as oil refining operations which include processing many flammable products and heavy type maintenance work?

The comparative compensation insurance rates for these two industries do not present the true picture. The true facts are that the refining industry long ago recognized the hazards of its operations and has done something about them.

The fertilizer industry can do the same.

Fire Losses

The fire loss records of the fertilizer industries are not good and we have been informed that fire insurance in some locations is difficult to obtain and that fire insurance rates in general are excessively high. Like excessive high compensation insurance costs, fire insurance rates are established by the insurance underwriters on the loss ratios over a period of time. Can we or should we blame the insurance underwriters for our high insurance costs?

The high cost of insurance is coming directly out of the profits of business and now that these established rates are nationwide in effect, an improvement must be made before any general reduction in costs can be accomplished on an overall and nation-wide basis in the accident and fire experiences. Forgetting all other benefits derived from a safety and fire prevention program the fertilizer safety movement can be justified on the reduction in insurance costs.

Goals Established

There may be some who are not familiar with the goals established for accomplishment by the Fertilizer Safety Section among which are the following:

1. Reduction in lost-time accident frequency and severity rates.
2. Reduction in workmen's compensation insurance rates.
3. Reduction in fire losses.
4. Lower fire insurance rates.
5. Safe and efficient work practices which will result in substantial reduction in operation and overhead cost.
6. Higher morale of employees.

Let us consider how these goals can be reached. The primary and basic steps toward any good safety and fire prevention program in any plant are in the engineering design and the policies of that company. Are you designing for safety to employees and for good fire prevention? Are all of your machines properly guarded? Does the electrical equipment in your plant comply with the national electrical code for that type exposure? When tanks and piping are installed, do you follow the recommendations of the API-ASME or its equivalent code in these installations? What provisions have you already made to make it easy for your employees to work safely, for example: good ventilation, good lighting and good housekeeping?

What consideration have you given to corrosion when purchasing equipment? What type construction do you use in building your plants and/or warehouses, are they fire proof and if not, do you have automatic fire control or extinguishment equipment?

Some will say all of these are not practical in the fertilizer industry and the cost would make our business unattractive and non-profitable. Have any of you gentlemen experienced how unprofitable a fire can be? After all is said and done, a fire can do more to interrupt continued supply of your products to your consumer and effect costs more than any other cause.

Have you considered layout when building your plant to reduce by isolation the damage in event a fire does occur? In view of the present high fire insurance rates it is imperative that the fertilizer industry consider employing best design practices for fire prevention in construction or remodeling of plants. Adequate and proper type hand fire extinguishment equipment is especially important for plants of combustible construction.

Does your training program include teaching each emplcyee how to use the fire suppression equipment? Adequate fire water systems for the expected exposure should be considered as important as the operating equipment of the plant. Until at least some of these are accomplished the present high compensation and fire insurance rates for the fertilizer industry will continue to be in force. It has been my experience that the greatest number of serious personal injuries are experienced during fires.

Importance of written operating instructions and job training programs have been demonstrated time and again in industry and these programs consistently result in safer and more economical work accomplishments.

Pesticides Included

The fertilizer industry, which includes the manufacture of insecticides, now has spread to all sections of the country, making it imperative that the Fertilizer Section Safety and fire prevention programs be applicable on a national basis. In our opinion before comprehensive reduction in compensation and fire insurance cost can be accomplished a general overall reduction in industrial injuries and fire losses must be evidenced and established over a considerable period of time. I am reminded of

(*Continued on page 74*)

PROGRESS

Junior is a typical example of progress in the United States. A car gets him to and from school more quickly and efficiently.

•

RAYMOND MULTI-WALL PAPER SHIPPING SACKS are typical examples of progress in the packing and shipping field.

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Fertilizer practice needs some revision according to data on

Phosphorus Accumulation in Soils

By M. T. Vittum
N. Y. State Agr. Exp. Sta., Geneva, N. Y.

IN MOST SOILS of eastern United States, phosphorus is the first of the mineral nutrients to limit the growth of annual crops. This fact was recognized early by farmers and soil scientists so early practice and recommendations called for application of materials containing phosphorus, such as guano, fish and bones.

Following the discovery of the superphosphate process by Lawes and Gilbert and the improved pig iron process (which produced basic slag as a by-product) by Thomas and Gilchrist, use of phosphate fertilizers increased rapidly until, during 1950, almost 11 million tons of superphosphate, 18 per cent A.P.A. basis, were produced in the country. A major part of this fertilizer was used in states east of the Mississippi.

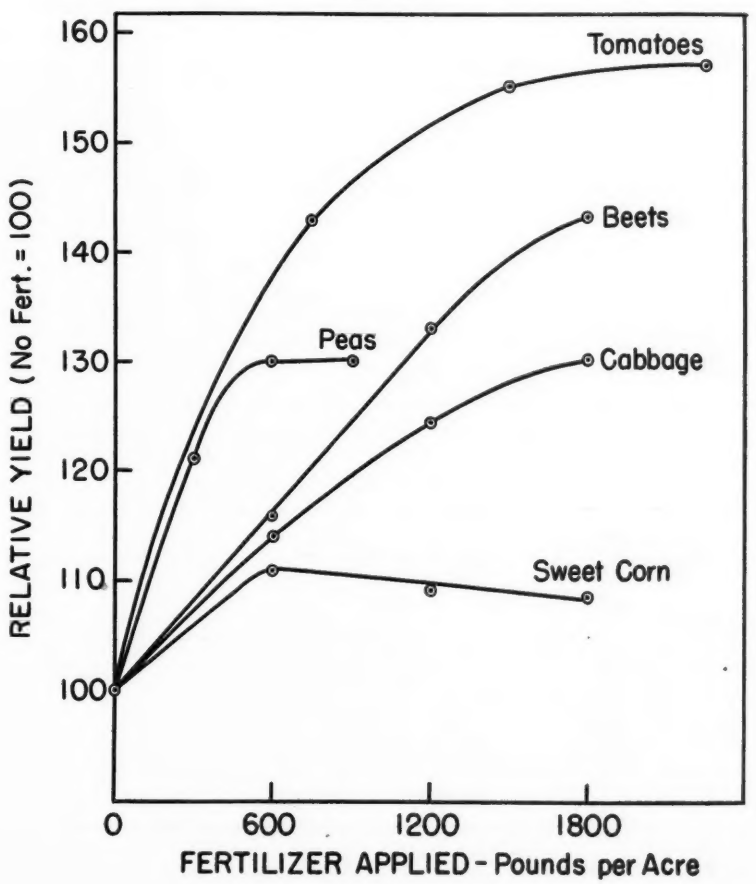
Phosphate Fixation

Efficiency of phosphate fertilizers is very low—seldom more than 15 to 30 per cent of the added P_2O_5 utilized by the crop to which it is applied. Thus, most agronomists recommend an application of at least three times and as much as five or six times the amount of P_2O_5 to the soil as will be used by the crop. Fortunately, or unfortunately, the surplus not used by the crop is not leached from the soil but is stored or "fixed" in chemical forms which are essentially unavailable to plants.

Dr. George Scarseth of the American Farm Research Association compares phosphorus in the soil to a monkey in the jungle: "One could not throw a monkey far through a thick jungle growth because arms, legs or tail soon would catch a limb or vine to hang onto. Phosphorus in the soil likewise gets tangled up in many similar ways, tends to be hard to move and is hard to keep soluble and available."

Fixing capacity of soils is determined by their chemical and mineralogical composition and, for all practical purposes, can be changed by man only by changing the soil acidity or *p*H. In a very acid soil, *p*H 5.3 or below, phos-

Fig. 1. Effect of increasing amounts of fertilizer on the yields of five vegetable crops.



phorus is fixed as insoluble iron and aluminum phosphates which are unavailable to plants.

As soil acidity decreases, *p*H 5.3 to 6.0, soluble iron and aluminum decrease and phosphorus is fixed by adsorption by soil colloids (clay particles). This type fixation is not nearly as severe as the type mentioned previously, for plant root hairs are able to take some of the adsorbed phosphate away from the clay particles.

More Liming

With further liming, at *p*H 6.0 to 7.0, soil phosphorus in the form of mono-calcium and mono-magnesium phosphates is readily available to plants. In other words fixation is at a minimum. As the soil crosses the neutral point and becomes alkaline, *p*H 7.0 and above, the phosphorus again is fixed, this time by calcium as insoluble tri-calcium phosphate. Thus, for minimum fixation and maximum availability, soil should be maintained at *p*H 6.0 to 7.0.

If, through the years, more phosphorus is added to the soil than is removed by the crops growing on that soil, fixing capacity of the soil is at least partially saturated and available phosphorus begins to accumulate in the soil. This is especially true in soils with acidity in the optimum range of *p*H 6.0 to 7.0. In areas of intensive production of such crops as vegetables and potatoes, where large quantities of chemical fertilizer have been applied in the past, chemical soil tests reveal a marked accumulation of available phosphorus in the soil. In numerous instances data reveal a need for revision in fertilizer practice. An example is cited in results obtained at the New York State Agricultural Experiment Station at Geneva.

Fertilizer Experiment

In a fertilizer experiment started in 1945 on a field which had been in a well-fertilized vegetable canning crop rotation for the pre-

Table 1. Fertilizer Treatments—Pound per acre

Treatment Code	Rate	Peas (5-10-10)	Beets, Cabbage, and Sweet Corn (5-10-10)	Tomatoes (4-12-8)
H	None	0	0	0
G	Low	300	600	750
I	Medium	600	1200	1500
J	High	900	1800	2250

Table 2. Response of vegetable canning crops to increasing amounts of fertilizer[1]

Treatment Code	Rate	Peas (pounds)	Beets (tons)	Cabbage (tons)	Sw. Corn (tons)	Tomatoes (tons)
H	None	1990	8.8	18.0	4.33	4.91
G	Low	2410	10.2	20.5	4.80	7.02
I	Medium	2580	11.7	22.4	4.73	7.62
J	High	2590	12.6	23.4	4.70	7.71
Difference required for significance, odds 19:1		160	0.9	1.4	0.34	0.58

[1] Average of three years for sweet corn; average of four years for all other crops.

Table 3. Soil *p*H and available P after 5 years of cropping

Fertilizer Treatment Code	Rate	pH	Phosphorus (P) Applied[1]	Phosphorus (P) Found[2]
H	None	7.39	0	28
G	Low	7.34	23	43
I	Medium	7.16	46	58
J	High	7.20	69	75
Difference required for significance, odds 19:1		0.10	—	8

[1] Average annual application, 1945—1949.

[2] In soil samples taken in late summer and early fall of 1949.

Table 4. Interpretation of the New York soil test for phosphorus

Relative value	Pounds per acre*
Low	0–8
Medium	8–20
High	20–40
Very high	>40

* 2,000,000 pounds of soil

ceding 20 years, some of the plots received no further fertilization for the six-year period 1945 to 1950. Other plots received "low", "medium" and "high" rates of fertilizer during the six-year period (Table 1).

The same treatments were applied to individual plots each year so that the cumulative effect of six years of continuous application of each treatment could be determined.

Four fields were included in the experiment so four different crops could be grown each year. Yield responses of five vegetable canning crops (peas, beets, cabbage, sweet corn and tomatoes) are summarized in Table 2, where it is apparent that for all crops except sweet corn, yields increased with increasing increments of fertilizer. Soil tests, tissue tests and deficiency symptoms have led workers at Geneva to conclude that the yield responses obtained in this experiment have been caused chiefly by nitrogen. It is interesting to note (Figure 1) that of the five crops grown in this experiment tomatoes and beets responded most readily to large amounts of fertilizer; sweet corn responded least while peas and cabbage were intermediate.

Soil Tests

Plots on which this experiment was located offered an excellent source of material for calibrating chemical soil tests with crop yields; hence, during the late summer and early fall of 1949, the fifth crop season, soil samples were taken from each of the 64 plots.

Each sample was a composite of borings of the surface six inches taken at random from 20 locations within the plot. The samples were taken to the Agronomy Department at Cornell where, under the direction of Professor D. J. Lathwell, *p*H was determined and the nitrate and ammonium nitrogen, P, K and Mg were analyzed according to methods used in that laboratory. Because this discussion is concerned with phosphorus only *p*H and soil phosphorus results are summarized in Table 3. The details of the other tests are reported elsewhere[1].

Most striking fact revealed in Table 3 is that after five consecutive years of cropping without addition of any fertilizer (Treatment H), the soil still contained 28 pounds of available P per acre.

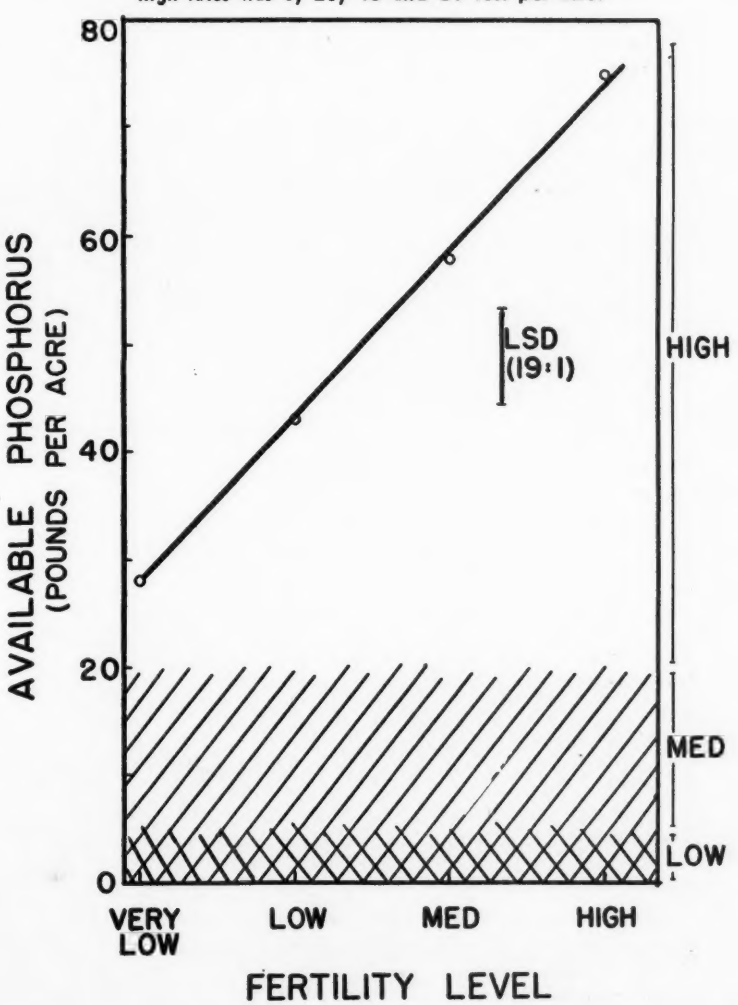
According to present standards in New York (Table 4), this would be classified as high. This high value must represent accumulations which resulted from heavy phosphorus fertilization in the years prior to initiation of the present experiment in 1945.

As might be expected, increasing the annual application of fertilizer

(*Continued on page 63*)

[1] *Vittum, M. T., Lathwell, D. J. and Stanford, G. Effect of different sources and rates of application of fertilizer materials on the pH, and N, P, K and Mg content of the soil to which they were applied. Soil Sci. Soc. Amer. Proc. 16, No. 3, 1952. (in press).*

Fig. 2. Effect of increasing amounts of fertilizer on available phosphorus in the soil. Average annual application of P for very low, low, medium and high rates was 0, 23, 46 and 69 lbs. per acre.



How You Can Get

Free Information

On each of the two postage-paid postcards below you can request further information on four items described on this and the Industrial News section of this issue. *Fill out one quarter section for each item in which you are interested.*

9-3 Portable Loader

A portable truck and boxcar loader that can be bent to a 90° curve while under power is now being made by Power-Curve Conveyor Co. It is reversible and speedy, delivering up to 30 bags a minute, according to literature on the loader. It can be built to fit specifications, which makes its application almost unlimited. The Power-Curve is economical—replacing three men with one. **Code Number 9-3.**

9-4 Carbo-Kote

Carboline Co. offers a pamphlet describing Carbo-Kote 6020, a special Furan Base thermosetting resin for lining tanks and for the protection of process and mechanical equipment against corrosion. Carbo-Kote is easy to apply in any location and its use requires no special safety precautions. It is, according to the manufacturer, in use in many instances where baked-on linings, lead, rubber, glass or stainless steel were formerly required. **Code Number 9-4.**

9-5 Oscillating Conveyor

An eight-page illustrated booklet on oscillating conveyors is offered by Link Belt Co. The booklet is a complete guide to the correct selection and application of Flexmount conveyors in stock sizes. A chart showing conveyability of various materials is included, together with dimensions and specifications of stock components. The Flexmount conveyor is designed expressly for light duty applications, particularly in chemical processing. **Code Number 9-5.**

9-6 Barden Clay

A four-page technical brochure describing properties of Barden clay, a low-cost pesticide diluent, has been published by J. M. Huber Corp. The brochure discusses 13 important factors in choosing a pesticide diluent and the properties of Barden clay in each of the

Here is a list of the NEW PRODUCTS and BULLETINS described on this and the Industrial News pages of this issue giving their monthly code number.

- 9-1 Bin-Vue Indicator
- 9-2 Stauffer Products
- 9-3 Portable Loader
- 9-4 Carbo-Kote
- 9-5 Oscillating Conveyor
- 9-6 Barden Clay
- 9-7 Grinding Units
- 9-8 Dust Separator
- 9-9 Rotary Crusher
- 9-10 Corrugated Metal
- 9-11 Tank Gauge
- 9-12 Mineral Filler
- 9-13 Corrosion Protection
- 9-14 Filling Scale

FILL OUT READER SERVICE CARDS

FARM CHEMICALS Code Number
Name
Title
Company
Co. Address

FARM CHEMICALS Code Number
Name
Title
Company
Co. Address

FARM CHEMICALS Code Number
Name
Title
Company
Co. Address
52-9

FARM CHEMICALS Code Number
Name
Title
Company
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FARM CHEMICALS Code Number
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Title
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FARM CHEMICALS Code Number
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52-9

categories. Tables comparing Barden clay with other commonly used diluents also are included. **Code Number 9-6.**

9-7 Grinding Units

Hardinge grinding units are the solution to any small-scale, continuous wet or dry grinding or pulverizing problems, such as those which occur in pilot plants, laboratories or small commercial processes, according to the manufacturer, Hardinge co., inc. Completely self-contained and portable, the units require only power and water connections to be placed in operation. The units have proven highly successful in a number of commercial and industrial applications. A descriptive leaflet is available from the company. **Code Number 9-7.**

9-8 Dust Separator

Sterling Centrifugal Dust Separators are designed to handle efficiently the volume of air discharged by fans with clean separation and low resistance to the flow of air. Separators are constructed of heavy gauge, copper bearing rust-resisting galvanized sheet steel, securely rivited. The new Sterling packaged dust collecting unit was specially developed to collect dust from individual machines or from several concentrated dust points. The unit returns filtered clean air to the room. **Code Number 9-8.**

9-9 Rotary Crusher

To be sure you have the right crusher for the job, get a copy of Sturtevant Mill Co's Rotary Fine Crushers catalog. These rugged crushers speed output of fines, cut reduction costs. Desired fineness is quickly obtained by regulating a hand wheel. "Open-door" accessibility permits fast, easy cleaning. They crush fine, crush fast and do not clog. Crushers are available in output capacities from 1 to 30 tons per hour. **Code Number 9-9.**

9-10 Corrugated Metal

Reynolds Lifetime Aluminum Industrial Corrugated is being used in industrial construction more and more widely. Though only .032 inches thick, the insulation value means economy and comfort inside. Tighter weight, the manufacturer points out, saves on construction costs. Low maintenance and long life extend economy through the years. Roofing width is 35 inches, coverage 32 inches. Lengths vary from 5 to 12 feet, according to Reynolds Metals Co. Descriptive literature is available. **Code Number 9-10.**

9-11 Tank Gauge

A Liquidometer corporation tank gauge can be used to gauge all kinds of liquids. Approved by Underwriters' Laboratories, these gauges are 100 per cent automatic. The manufacturer has further information of interest to fertilizer and pesticide formulators and mixers. **Code Number 9-11.**

9-12 Mineral Filler

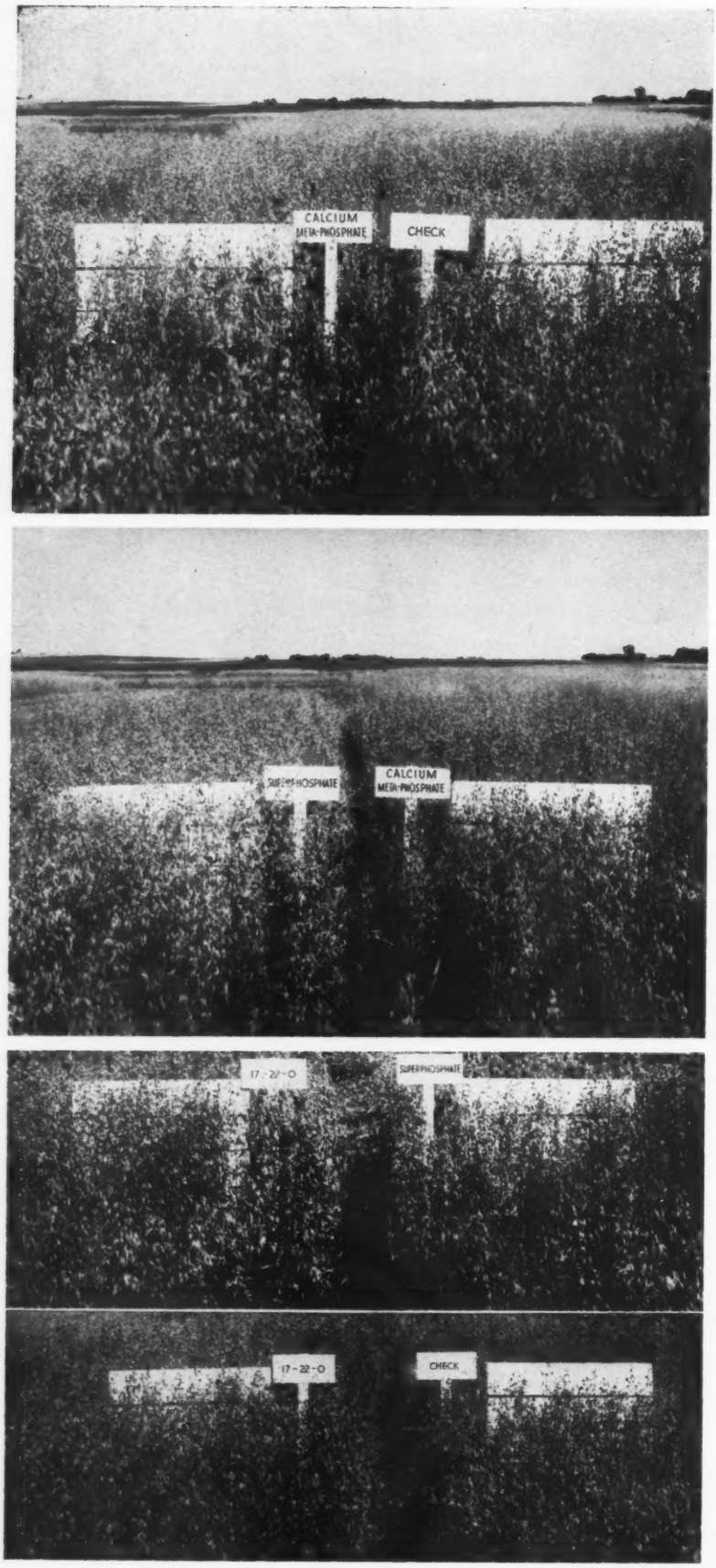
Many leading producers of insecticides are adding Celite Mineral Fillers to their dust as a standard ingredient to increase the effectiveness of their product. Because of their inertness and great bulk per unit of weight, these fillers make ideal bulking agents for powders and pastes. The manufacturer, Johns-Manville, has available further information and samples. **Code Number 9-12.**

9-13 Corrosion Protection

Only Bitumastic protective coatings can withstand ravages of corrosion over an appreciable length of time, according to Koppers Company, Inc., Tar Products Division. Unlike maintenance paints, Bitumastic coatings are specially formulated from a base of coal tar pitch that is impervious to water. They provide an extra-thick barrier against corrosive elements—a coating which provides eight times the film thickness of conventional paint coatings. There are six Koppers coatings formulated to control corrosion of metal and deterioration of concrete. The manufacturer has booklets on corrosion prevention. **Code Number 9-13.**

9-14 Filling Scale

Fertilizers now can be automatically net-weighed and bagged by Thayer Scale & Engineering Corporation's new Model 400N filling scale at speeds up to 12 per minute for 50 lb. bags and 10 per minute for 100 lb. bags. Performance is guaranteed to be accurate to 0.1 lb. for any desired weight from 25 to 200 lb. It is equipped with a self-gripping bag holder, an automatic net-weighing hopper, a supply tube, an air-operated feeding gate and an automatic check-weighing and bag-releasing system. Literature is available telling more about the Model 400N. **Code Number 9-14.**



All photos show growth of oats with different sources of phosphate on Carrington loam, an acid prarie soil in Howard county, Iowa. All plots received 31 pounds of nitrogen per acre. Phosphated plots received 40 pounds of P_2O_5 per acre drilled with the seed. Acre yields in bushels: check—63.7; superphosphate—73.8; calcium metaphosphate—69.3; 17-22-0—69.8. The 17-22-0 is one of TVA's new nitric phosphates.

Investigations with radioisotopes shed light on question of

THE question of whether superphosphate should be applied in a band near crops or mixed generally with the soil for best crop yield has been facing agricultural personnel.

New light is shed on the subject in a paper presented at the annual review of soil and fertilizer investigations with radioisotopes. The paper, prepared by C. A. Black, professor of soils, Iowa Agricultural Experiment Station, is one of seven from all sections of the country which tell of the experimental work with radioactive tracers in the sections.

Prof. Black's paper is called "The Influence of Kind of Fertilizer Material and Placement on Utilization of Fertilizer Phosphorus by Crops.

Recently FARM CHEMICALS presented digests of three of the radioisotope papers. This month

Banded or Drilled Super Placement?

we present Prof. Black's paper.

Text of Prof. Black's paper, representing work in the North Central Region, follows:

As a result of experiments through the years, there has emerged the generalization that with small applications of superphosphate for row crops, the amount of superphosphate required in the production of a given increase in yield is about twice as great if the phosphate is broadcast and mixed with the soil as if it is placed in a band near the seed.

Figure 1 shows the results of an experiment on superphosphate placement for sugar beets in Michigan that sheds new light on the problem of superphosphate placement. In this experiment, 50 pounds of P_2O_5 as superphosphate were applied per acre in a band to one side of and below the seed. The same amount was applied throughout the soil before planting using a fertilizer-grain drill. In one case only the banded phosphate was tagged with P^{32}, and in the other, only the drilled application was tagged.

The results in Figure 1 indicate that the early season effect was greater with the band than with the drilled placement and that the late season effect was greater with the drilled than with the band placement.

It appears, therefore, that if production of maximum yield response to phosphate required the absorption of fertilizer phosphate early in the season, the band application would be more effective than a drilled or broadcast application. On the other hand, if production of maximum yield response required the absorption of fertilizer phosphate throughout the season, as in soils low in available phosphate, fertilizer phosphate should be present both in the band and mixed throughout the soil.

Relative Value

The relative value of applying a given amount of superphosphate in a single band and of dividing it equally between two bands, one on each side of the seed, was tested with corn in Iowa and Wisconsin. Table 1 shows that the percentage of the plant phosphorus derived from the fertilizer was greater with two bands than with one.

Table 2 shows that the corn yield with two bands was lower than with one band in Iowa, and higher in Wisconsin. Of all the data in these two tables, however, only the difference in percentage of the plant phosphorus derived from the fertilizer in the Wisconsin experiments were statistically significant.

It appears from these results that if the experiments had been of sufficient accuracy to measure small differences in corn yields, the two-band application would have been found superior to the single-band application.

Corn seed usually is planted about two inches deep. Most planter attachments for applying fertilizer to corn in the corn belt place the fertilizer above the level of the seed. At times, the fertilizer is essentially at the surface of the soil.

Table 3 shows the average results of experiments in Iowa, where a single band of superphosphate was placed at different depths. The percentage of the plant phosphorus derived from the fertilizer was greater with the band at the two-inch depth than it was at the one-half-inch or five-inch depths. The yields followed the same general trend as the fertilizer phosphorus in the plant, but the yield differences were not statistically significant.

Average Results

Table 4 shows the average results of similar experiments in Wisconsin. The results here were about the same as those in Iowa.

The superiority of the two-inch over the one-half-inch placement depth found in the Iowa experiments was not unexpected because of the limited movement of phosphate and the frequent dryness of the surface layer of soil. The superiority of the two-inch over the five-inch placement depth can perhaps be accounted for on the basis that the first roots sent out by the corn plant move approximately horizontally in the soil.

Table 5 shows the results of three experiments in Iowa on placement of phosphate for oats. From the standpoint of both absorption of fertilizer phosphorus and yield, both experiments on the acid soils showed that drilling the phosphate with the seed was a little better than broadcasting the phosphate and drilling the seed.

The yield differences were not significant, however. On the calcareous soil, the placement differential caused no significant difference in either plant phosphorus derived from the fertilizer or yield. These results confirm previous Iowa experiments showing that concentration of soluble phosphate in a small volume of soil by banding or granulation is important in neutral and acid soils but that wide dispersion of the phosphate may be desirable in calcareous soils.

The average hay yields obtained with different phosphates as a top-dressing for established meadows in three experiments in Iowa are shown in Table 6 (data on per-

centage of the plant phosphorus derived from the fertilizer are not yet available). In these experiments, the yield was the same with <40-mesh calcium metaphosphate as with concentrated superphosphate, but the yield with <10-mesh calcium metaphosphate was lower.

Figure 2 shows the results of an experiment in Ohio comparing superphosphate and calcium metaphosphate as sources of phosphorus for corn. The percentage of the plant phosphorus derived from the fertilizer was much greater with superphosphate than with calcium metaphosphate early in the season, but the difference became smaller with time.

Equal Proportions

At the last harvest for radioactive phosphorus measurements, the fertilizers had supplied equal proportions of plant phosphorus. The yield from both sources was the same, and so the amount of fertilizer phosphorus absorbed was the same with both fertilizers.

Similar results have been obtained in experiments in Wisconsin.

The fact that by the end of the season the same proportion and amount of plant phosphorus came from calcium metaphosphate and superphosphate means that during the latter part of the season the corn was taking up phosphorus faster from calcium metaphosphate than from superphosphate.

Apparently the calcium metaphosphate did not decrease in availability as rapidly as did the superphosphate. Indeed, an experiment conducted this year in Colorado indicates that at least for a time the availability of phosphorus in calcium metaphosphate may increase in the soil. It may be speculated that because of this property, calcium metaphosphate may be the phosphate fertilizer we have been looking for to apply in the fall.

We may find also that on soils low in available phosphorus a combination of a band application of superphosphate and a broadcast application of calcium metaphosphate will produce a given increase in corn yield with less total phosphate than would be required with either superphosphate or calcium metaphosphate alone regardless of the method of application.

A number of experiments with

Table 1. Percentage of phosphorus in corn plants derived from a given amount of superphosphate applied in a single band or in a double band.

	Per cent of plant P from fertilizer			
Superphosphate placement	Iowa 1948	Wisconsin 1949	Wisconsin 1950	Wisconsin 1951
Single band	15	22	19	27
Double band	18	31	23	31

Table 2. Yield of corn with a given amount of superphosphate applied in a single band or in a double band.

	Corn yield, bushels per acre			
Superphosphate placement	Iowa 1948	Wisconsin 1949	Wisconsin 1950	Wisconsin 1951
Single band	62	126	78	91
Double band	61	131	81	93

Table 3. Percentage of phosphorus in corn plants derived from superphosphates, and yield of corn with superphosphate band at different depths in Iowa.

Depth of Superphosphate band, inches	Per cent of plant P from fertilizer	Yield of corn, bu./acre
No phosphate	—	55
0.5	11	59
2	15	62
5	9	61

Table 4. Percentage of phosphorus in corn plants derived from superphosphate, and yield of corn with superphosphate band at different depths in Wisconsin.

Depth of Superphosphate band, inches	Per cent of plant P from fertilizer	Yield of corn, bu./acre
2	30	100
3.5	28	102
5	18	98

Table 5. Percentage of phosphorus in oat plants derived from phosphate fertilizer, and yield of oats with phosphate fertilizer applied drilled or broadcast in Iowa.

	Per cent of plant P from fertilizer		Yield of oats bushels per acre	
Soil	**Drilled**	**Broadcast**	**Drilled**	**Broadcast**
Average of 2 acid soils	37	30	70	67
One calcareous soil	26	27	42	40

Table 6. Yield of legume—grass hay with different sources of phosphate applied as a top dressing to establish meadows in Iowa.

Source of phosphate	Yield of hay, tons per acre
Concentrated superphosphate	2.9
Calcium metaphosphate, < 40 mesh	2.9
Calcium metaphosphate, < 10 mesh	2.7
None	2.3

Table 7. Percentage of phosphorus in alfalfa plants derived from different sources of phosphate applied as a top dressing to established alfalfa in Minnesota.

	Per cent of plant P from fertilizer	
Source of phosphate	40 lbs./acre	120 lbs./acre
Concentrated superphosphate	15	47
α-tricalcium phosphate	4	8

Figure 1.—Percentage of Phosphorus in Sugar Beets Derived from Superphosphate Applied by Two Methods in Michigan.

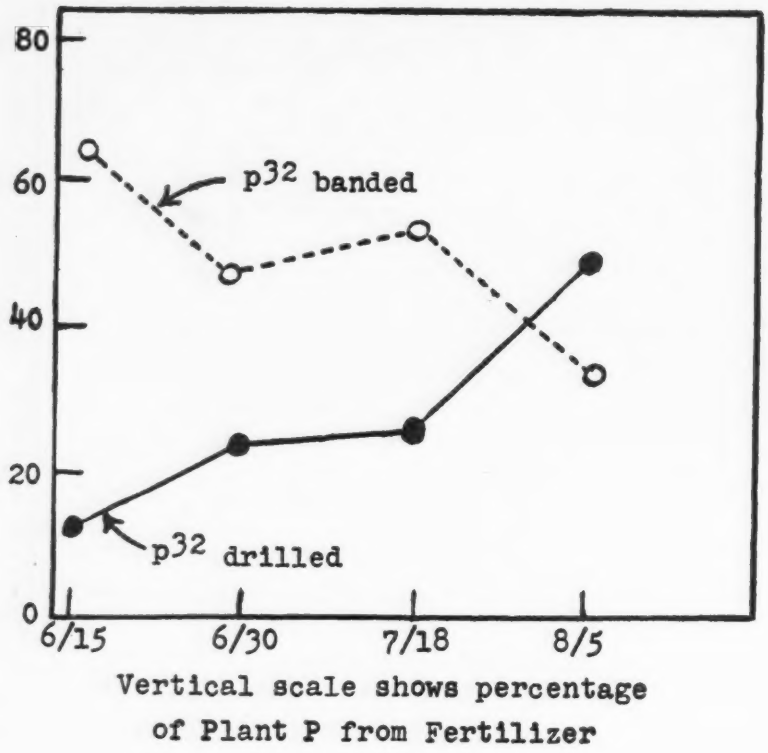
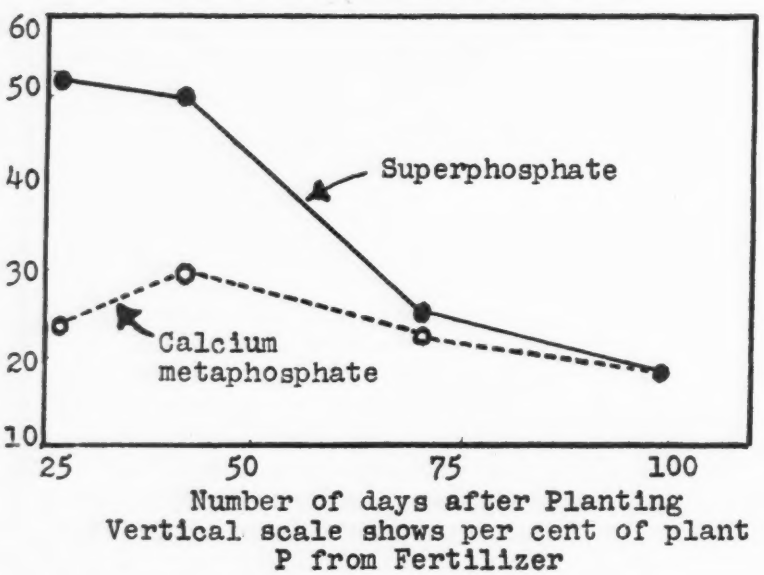


Figure 2.—Percentage of Phosphorus in Corn Plants Derived from Different Sources of Phosphate in Ohio.



different phosphates for oats have been conducted in Michigan, Wisconsin and Iowa.

Ammonium phosphate seemed to be a little better than superphosphate in the experiments. Ammoniated superphosphate and nitric phosphates showed up as well as superphosphates—sometimes a little better, and sometimes a little worse.

Calcium metaphosphate was sometimes as good as superphosphate and was sometimes quite a little poorer. Dicalcium phosphate and α-tricalcium phosphate were generally considerably poorer than superphosphate, and only occasionally gave results as good as superphosphate. ◆

Radioactive DDT Tests Resistance of Mosquitoes

Experiments performed on mosquitoes by C. M. Gjullin and A. W. Lindquist, Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, with radioactive DDT have measured the amount of the chemical absorbed by mosquitoes and degree to which they have become DDT-resistant. J. S. Butts, Oregon State College, also participated.

DDT was supplied by USDA's Bureau of Plant Industry, Soils and Agricultural Engineering. It was made radioactive by substituting radioactive carbon in the benzene used in the manufacture of DDT.

The scientists, working at the Oregon Experiment Station, measured the radioactivity of larvae and pupae which had absorbed the treated insecticide. The tests showed that DDT is more effective against the larvae than the pupae. Eleven times more DDT was necessary to kill pupae than to kill less resistant larvae.

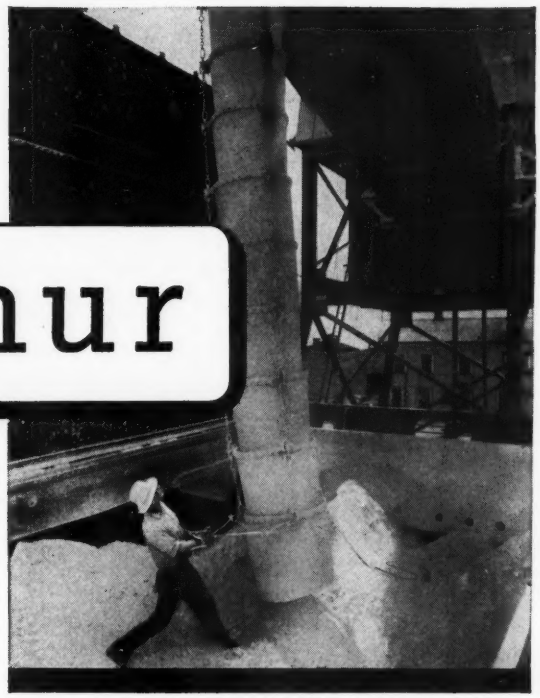
Other tests showed that larvae are much more resistant to DDT when temperature is high. Larvae were able to absorb nearly twice as much of the chemical at 90 degrees as at 70 degrees F., and the death rate was much lower.

Previous experiments indicated that mosquitoes from areas frequently treated with DDT have developed resistance to the chemical.

This was confirmed in tests when resistant larvae absorbed more than six times as much radioactive DDT as did nonresistant larvae, yet 20 per cent fewer resistant larvae died.

When DDT was used in a lighter dosage, resistant larvae absorbed twice as much as did nonresistant ones, with only 11 per cent mortality, compared with 100 per cent mortality for the nonresistant larvae.

Sulphur

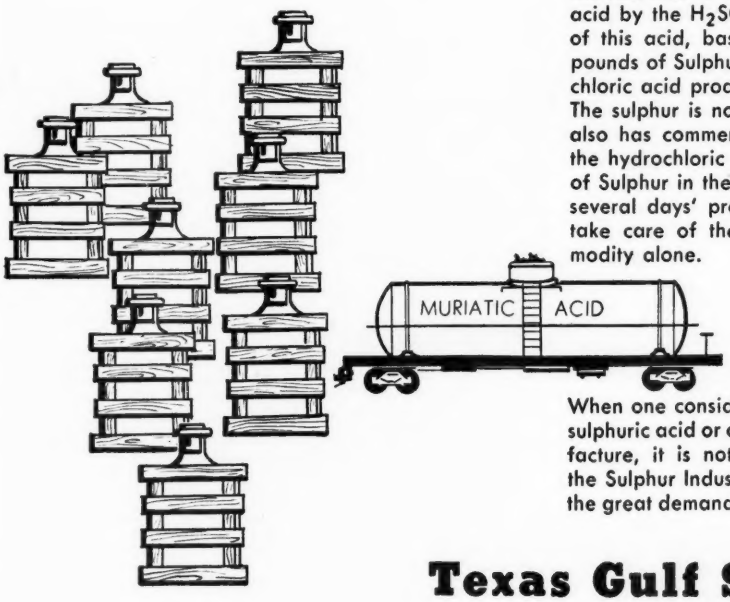


Loading a ship with Sulphur at Galveston

Thousands of tons mined daily, but where does it all go?

PARAPHRASING an old saying: 'It takes a chemical to make a chemical,' certainly applies to hydrochloric acid.

No chemical engineer has to be told how hydrochloric acid is made but sometimes with the mind focussed on the word "hydrochloric" little thought is given to another word "sulphuric." It is this word that calls attention to the fact that to make one net ton of 20° Bé hydrochloric acid by the H_2SO_4 process requires about 950 pounds of this acid, basis 100%, which is equivalent to 320 pounds of Sulphur. About one third of the annual hydrochloric acid production is made by the use of sulphuric. The sulphur is not lost because salt cake, a by-product, also has commercial value. But any way you figure it, the hydrochloric acid industry is an important consumer of Sulphur in the form of sulphuric acid. In fact, it takes several days' production from all the Sulphur mines to take care of the annual production of this one commodity alone.



When one considers all the other chemicals that require sulphuric acid or other Sulphur compounds for their manufacture, it is not difficult to appreciate how faithfully the Sulphur Industry is serving industry today in spite of the great demands made upon it.

Texas Gulf Sulphur Co.

75 East 45th Street, New York 17, N. Y.

Mines: Newgulf and Moss Bluff, Texas

FERTILIZER MATERIALS MARKET

New York

August 11, 1952

Sulfate of Ammonia

With the recent settlement of the steel strike, most plants were in production again but there still is a threat of a coal strike and if this occurs operations will again be reduced. Synthetic producers are shipping out as fast as production will permit.

Nitrate of Soda

Stocks were available at various ports for prompt shipment and a steady supply is looked for in the foreseeable future.

Ammonium Nitrate

An excellent and steady demand exists for this material and some buyers find themselves in need of additional material. No price changes were noted.

Nitrogenous Tankage

With leading producers sold up for the balance of the year, it was difficult to find any material available. Some imported material was offered at prices slightly higher than the domestic market.

Organics

Organic fertilizer materials were firmer in price because of the renewed interest from the feed trade in many of the materials. Due to drought conditions in various states, a large demand is expected for feed of all kinds. Tankage sold at $7 ($8.51 per unit N), and blood at the same price, f.o.b. Eastern points with the Western market even higher. Cottonseed meal was very firm. O.P.S. raised the ceiling price on linseed meal $6 per ton and the new price for 32 per cent protein linseed meal is $78. per ton f.o.b. Minneapolis. Soybean meal was scarce for nearby shipment and was selling at the ceiling price for future shipment.

Fish Meal

Because of a strike among domestic menhaden fishing fleets, operations were hampered seriously at certain points and the catch was restricted. Fish meal was selling at the ceiling price of $2.26 per unit of protein, f.o.b. shipping points. Various arrivals of imported material helped to augment the domestic supply.

Bone Meal

A steady demand was noted for this material at prices ranging from $70. to $75. per ton according to quality. No raw bone meal was available.

Hoof Meal

With the new import regulations expected to go into effect shortly, a decreased supply of imported material will be available. Domestic buyers will have to depend more on domestic supplies.

Superphosphate

With the shortage of this material apparently over, stocks were said to be increasing at several production points as producers found it increasingly difficult to get buyers to take material during the summer months.

Potash

A more normal situation has developed in this material and domestic producers are shipping against current contracts with one additional domestic producer expected to start shipping soon. Various lots of imported material have arrived recently, including one lot of sulfate of potash.

Cocoa Shells

Soon demand was noted for this material but supplies were rather short because of the decreased production.

Philadelphia

August 11, 1952

Normally the materials market is not very active at this time of the year. While settlement of the steel strike tends to ease the general nitrogen supply position, it is expected that during the present fertilizer year there still will not be sufficient nitrogen to meet all demands. Superphosphate is in much better supply, and potash production now is sufficiently ample to fill all contracts and allow also for some storage accumulation. The European market is offering liberal quantities of solid nitrogen, superphosphate and potash. Prices, however, are not too interesting at present.

Sulfate of Ammonia.—With settlement of the steel strike, deliveries are beginning to move and should be in normal volume in another week or two. It is suggested in some quarters that a price advance may be expected.

Ammonium Nitrate.—This is still in very short supply.

Nitrate of Soda.—Demand is much easier and stocks are quite sufficient to meet all requirements.

Blood, Tankage, Bone.—Blood and tankage have gained strength, with good demand, and present market is $6.75 to $7.75 per unit ammonia ($8.20 to $9.42 per unit N), depending on location. Bone meal shows some improvement in the demand but price remains at $75 per ton for steamed, and $70 for raw grade. Hoof meal is without interest.

Castor Pomace.—This continues to be in limited supply and is quoted nominally at $37.25 per ton at producing works.

Fish.—Demand is limited and menhaden meal is quoted at ceiling price. Considerable imported meal is in the market.

Phosphate Rock.—Situation is reported normal for this time of the year, with shipments moving regu-

larly against contracts, and no unusual demand.

Superphosphate. — Demand has subsided and spot material is now much easier. The improved acid situation has removed cause for concern as to supply for coming season. Tonnage in Europe is said to be considerable.

Potash. — Shipments continue against contracts. Demand is normal for this time of the year but is expected to show seasonal increase shortly. The future supply undoubtedly will be ample to meet all requirements, because of increased production in this country and plans for increased production in Europe.

Charleston

August 11, 1952

Except for the shortage of sulfate of ammonia caused by the steel strikes, supplies of other fertilizer ingredients currently are in comfortable position.

Organics. — Fertilizer manufacturers continue to show fair interest in organics, primarily for fall and spring shipment. Domestic nitrogenous tankage is priced at $4.60 to $5 per unit of ammonia ($5.59 to $6.08 per unit N), f.o.b. production points, bulk, with all producers heavily sold. Imported nitrogenous offerings are spotty, with prices varying from $6 to $6.10 ($7.29 to $7.42 per unit N) in bags, c.i.f. Atlantic ports for fall shipment.

Castor Pomace.—Domestic supplies are available in limited quantity for shipment through December at $37.25 per ton in burlap bags or $2.00 per ton less if shipment is in paper bags, f.o.b. Northeastern production points. Analysis is guaranteed minimum 6.75 per cent ammonia. Occasionally imported material arrives at prices around $45.00 per ton, ex-vessel, Atlantic ports.

Dried Blood.—The market has advanced somewhat in the Chicago area. Unground blood is indicated at around $7.25 per unit of ammonia in bulk ($8.82 per unit N). New York market is around $6.25 to $6.50 per unit ($7.59 to $7.90 per unit N).

Potash.—Production of domestic muriate of potash is heavily sold and price for 50 per cent and 60 per cent grade is 42 cents per unit K_2O, bulk, f.o.b. Carlsbad, New Mexico. Domestic sulfate of potash continues at 74½ cents per unit, K_2O, bulk, f.o.b. Carlsbad. Imported muriate of potash 58/62 per cent grade is offered at prices at the ports equivalent to domestic costs and in some instances, one to two cents below the domestic cost.

Ground Cotton Bur Ash.—This source of potash, primarily in the form of carbonate of potash, continues available for prompt and spread shipment. Current productions from best sources test around 40 per cent to 42 per cent K_2O and delivers, in most cases, about the same price as domestic sulfate of potash.

Phosphate Rock. — Movement from domestic sources continues at a satisfactory basis and prices remain firm and unchanged.

Superphosphate. — This article, both in 20 per cent and triple grade, continues in strong market position with demand in excess of supply, particularly triple superphosphate. Production continues at high levels limited only by the amount of sulfur available.

Sulfate of Ammonia.—The steel strike has reduced the production of coke-oven material considerably and this curtailment will be felt during the new fertilizer season, though no changes in price have been announced and demand is strong.

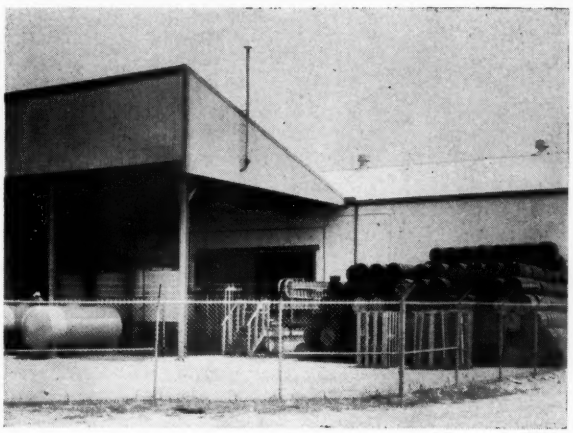
Nitrate of Soda.—Imported material is readily available and demand is seasonal. Domestic production also is adequate.

Calcium Ammonium Nitrate.—Supplies of this form of imported ammonium nitrate are expected to be available at the usual ports of entry for the new season.

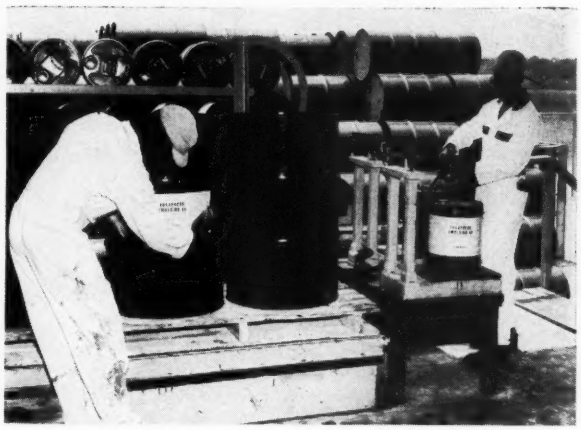
Industrial News

New Products **New Plants** **New Appointments**

New Pennsalt Emulsion Facilities



View of new Pennsalt facilities.



Finished emulsion concentrates being loaded.

New facilities for emulsion concentrate formulations have been added to the Pennsylvania Salt Manufacturing company's plant at Montgomery, Ala.

The new facilities are producing benzene hexachloride, DDT, Toxaphene and BHC-DDT combinations. Included are blending and mixing tanks and apparatus and weighing and conveying equipment. Four solvent storage tanks with a capacity of 60,000 gallons have been installed. Warehousing space has been increased 35 per cent and additional truck loading facilities have been included.

ACS Set for Convention In Atlantic City Sept. 14

Atlantic City, N. J. will play host to the American Chemical Society's 122nd national meeting to be held Sept. 14–19.

The Division of Agriculture and Food Chemistry will conduct several symposia, including one on the formation and action of weed killers under the chairmanship of Prof. Alden Springer Crafts, Department of Botany, University of California.

"The Potentials of Fertilizer Use for More Efficient Crop Production" will be the theme of a symposium conducted by the Division of Fertilizer and Soil Chemistry. A technical session on some of the properties of amino acids, proteins and peptides will be sponsored by the Division of Biological Chemistry.

Registration will begin during the afternoon of Sept. 14, and sessions will begin the next morning. Hotel Traymore will serve as general headquarters. Divisional meetings will be held in Convention Hall, Haddon Hall, and Hotel Chalfonte.

An exhibit of books on chemistry, excursions to chemical plants in the vicinity and a special program for women chemists and wives of the chemists are planned.

NPA Announces Changes

Shifts in the National Production Authority's list of scarce materials were announced this month. Removals include copper-8-hydroxyquinoleate and nicotinic acid. Additions affecting the farm chemicals industry are cryolite, benzene, DDT, 2, 4-D, pine oil and sodium chlorate.

Cyanamid Appoints Gleissner

Dr. Bruce D. Gleissner has been appointed manager of the insecticide division of American Cyanamid company.

Dr. Gleissner started his career at Pennsylvania State College where he was assistant professor of entomology.

Endothal Is Marketed For Use As Defoliant

Claimed by the manufacturer to be the first complex organic chemical compound successfully used for defoliation, Endothal S-4069 is being marketed this season in limited quantities by Pennsylvania Salt Manufacturing company.

The agricultural applications of endothal (dicodium 3, 6 endoxohexahydrophthalate) were discovered early in 1948 by Sharples Chemicals, Inc., a subsidiary of Pennsalt. Since that time endothal has been extensively field tested and although this program is continuing through the present season, it has developed far enough so definite commercial uses have proved practical.

Tests on pre-emergence and post-emergence treatment on the basis of individual plant tolerance have shown favorable results on weeds not normally controlled by other chemicals and difficult to control by cultivation.

Industrial News

Hough Wins Putman Award

Raymond P. Wiggers, advertising manager for Frank G. Hough Co., accepts Putman award plaque at National Industrial Advertising Assoc. convention.

Raymond P. Wiggers, advertising manager of Frank G. Hough Co., received the Putman Award of $1000 at the recent convention of National Industrial Advertisers Association. A $750 award was made to Ray B. Thomas, account executive of Hough's agency, Erwin R. Abramson.

Established by Col. Russell L. Putman, president of Chicago's Putman Publishing Co., in 1948, the awards are presented "for the best use of industrial advertising . . . and the best documentation of such use . . . in making more effective the selling of products or services to industry." Advertising results shown in winning entries must be proved to the satisfaction of top industrial executives. Only top management men are selected as judges for the contest.

Hough and its agency also won first prize in 1950.

They are the first in history to win the award twice.

Stauffer Obtains Rights For New Super Process

Stauffer Chemical Co. has obtained exclusive American rights to a new process for production of ammoniated superphosphate, according to a recent announcement. The process, developed and patented by Rumianca, Societa Per Azioni, Turin, Italy, produces a pelleted material containing nitrogen and phosphorus in amounts which can be varied over a wide range, depending on demand.

About the same proportion of phosphate is water soluble in the material made by this process as in single superphosphate. The material may be bagged or shipped without the aging period usual in superphosphate manufacture. This reduces the cost of the plant by eliminating the need for storage facilities for curing single super.

The capacity of existing plants may be enlarged by the use of this process without the need for additional storage. The raw materials are the same as in the standard processes — phosphate rock, sulfuric acid and ammonia.

Stauffer will make the process available to other producers under sub-licensing agreements.

9-1 Bin-Vue Level Indicator

Positive, foolproof signals always are available with the new Bin-Vue materials level indicator. It's designed with a minimum of parts. Bin-Vue has no diaphragms to go out of order. It gives a positive, foolproof signal wherever installed. Simple mechanical reaction to any dry bulk materials in bins assures you true signals and trouble-free operation.

It is powered by 1/200 hp. 110 volt, 60 cycle motor, but can be supplied in any voltage. Beside the standard model, Bin-Vue is also available in stainless steel, monel or a totally enclosed model. It provides an effective method for starting and stopping other equip- in automatic control systems. For further information fill out a **Reader Service** card, using number **9-1.**

Dow Chemical Announces Three Personnel Changes

Three changes in the research staff have been announced by Dow Chemical Co.

L. C. Chamberlain, manager of research for the plastics department since 1945 has been named assistant to the director of research. Chamberlain, a graduate of Tulane University, joined Dow in 1928, becoming assistant director of the laboratory in 1941. He was placed in charge of plastics in 1945.

Raymond F. Boyer will replace Chamberlain as head of plastics and high polymer research. He received his master's degree in physics from Case Institute of Technology in 1935 and began work in Dow's physical research laboratory where he specialized in the physical chemistry of plastics.

Dr. William C. Bauman succeeds Boyer as director of the physical research laboratory. He likewise entered Dow's physical research laboratory immediately after taking his Ph.D. in physical chemistry from Yale University in 1938, and became assistant director of the laboratory 16 years later.

FROM FIRST COST TO LAST

LESS PACKAGING EXPENSE

WITH

CHEM-PAK

DEPENDABLE SIFT-PROOF PAPER BAGS SPECIALLY ADAPTED FOR SHELF-UNIT PACKAGING OF CHEMICAL PRODUCTS

CHEM-PAK

BAG TYPES FOR MANY NEEDS

Heavy-duty construction; wax-treated or asphalted paper when desirable
Paper combinations to protect against moisture, odor, grease, vapor, etc.
Excellent printing characteristics
Cut so paste can't ooze
Protective "shingle" construction; no open area through which contents can sift

CHEM-PAK STANDARD

Made with the original and justly famous Union sift-proof feature.

Thermoplastic applied to inside top portion of bag
Closure can be made on standard heat-sealing equipment
Paper combinations to suit the individual protective qualities desired
Excellent printing surface for shelf display packages
Bottom has famous Union sift-proof "shingle" construction

CHEM-PAK UNISEAL

Standard CHEM-PAK with a thermoplastic application to effect a heat sealed closure.

Can be closed on standard heat-sealing equipment
Heat-sealing top guarantees a sift-proof closure
Unithene, chemically inert lining for packing Class "B" poisons, corrosive and hygroscopic chemicals
Bottom squares out flat for easier packaging, better shelf display
Bottom both heat sealed and adhesive reinforced

CHEM-PAK UNITHENE*

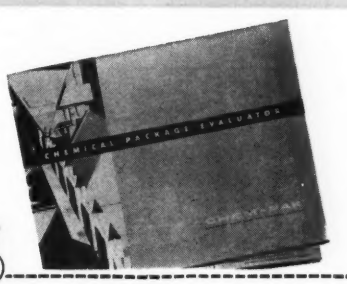
Special Duplex paper combination. Inner ply — Unithene.*

*UNITHENE—*Union high-test kraft with control-coated polyethylene.*

VERSATILE CHEM-PAK bags are certified sift-proof. They meet requirements of the Interstate Commerce Commission — are safe even for Class "B" poisons. You'll find them an excellent solution for most packaging problems where dry chemicals are put up in units of twenty-five lbs. or less.

CHEM-PAKS are made in a wide range of paper combinations and closures, suitable for almost any dry chemical sold in small retail units. Their protective qualities compare favorably with more expensive containers. They are easy to handle, inexpensive to pack and ship, colorfully suited to retail display.

Measure your present package against CHEM-PAK. You can make a quick, accurate appraisal with Union's new Chemical *Package Evaluator*. This handy guide is yours for the asking. The coupon brings it.



CHEM-PAK

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Industrial News

Sulfur Group Recommends Extension for Inventory

Raising the National Production Authority's 25 calendar day inventory limitation on sulfur supplies to 60 calendar days recently was recommended by the Native Sulfur Industry Advisory committee.

Sulfur inventories are limited to a 25 day supply at currently scheduled rates of operation under an amendment to the Commerce Department agency's Sulfur Order, M-69, issued Nov. 9, 1951.

25 Day Limit

The 25 day limitation, however, permits barge or vessel shipments which may amount to as much as a three or four month supply providing no additional deliveries are received as long as inventories exceed requirements by 25 calendar days.

Producers' sulfur stocks, which continued downward to the end of March of this year have since increased, says NPA. Beginning in April, sulfur consumption fell below the amounts authorized under the 90 per cent of 1950 usage limitations of Order M-69. For the first six months of 1952, difference between authorized consumption and actual consumption was estimated at 123,000 long tons of elemental sulfur. NPA ascribed part of this shortfall to the effects of the steel strike.

Higher Level

In addition, production of Fraschmined and recovered elemental sulfur thus far this year is at a slightly higher level than for the corresponding period of 1951.

According to a Bureau of Mines representative, elemental sulfur in the hands of producers on June 30 increased 93,000 long tons from the Jan. 1, 1952 total of 2,906,000 long tons.

NPA stated that sulfur supply and requirements have become much more nearly in balance in recent months and estimated that inventories in the hands of consumers amount to about a 34 day supply.

Loucks, McKenzie Promoted

Charles P. Loucks and John D. McKenzie recently received promotions from International Minerals and Chemical corporation's Industrial Minerals division.

Loucks, formerly field engineer to the foundry industry and assistant to the general manager of Eastern Clay Products department, is a graduate of Massachusetts Institute of Technology in industrial engineering.

McKenzie was a technical economist and assistant to the vice-president of the Research division. He joined International in 1950. He is a Purdue University graduate in chemical engineering and University of Pennsylvania as an M. B. A.

Industrial News

Mexican Sugar Producers To Start Soil Experiments

Soil and fertilizer experiments are being made by the experimental field offices of the National Union of Sugar Producers in an attempt to work out a program for technical maintenance of soil in each of the cane producing areas of Mexico.

A soil laboratory has been established where physical and chemical properties of the respective soils are to be charted. Data, gathered with recommendations of laboratory workers, will be made available to sugar mills.

Studies have already begin in areas bordering the sugar mills of El Potrero, Veracruz and Atencingo, Puebla as well as Xicotencatl, Tamaulipas. Soil characteristics have been broken down in field offices and sections of land have been set aside to show how soil improvement is reflected in increased commercial production. Tests with fertilizers are also being noted so that cane crop development can be increased on a scientific basis.

The program will be extended throughout Mexican cane areas. This is the first time a serious attempt has been made to provide soil improvement data and results of fertilizer experiments on a large scale. Current experiments are limited to cane crops.

. . . Grasshopper

(*Continued from page 37*)

ment as soon as the insects are just starting to move into the fields and slight feeding damage is apparent.

Marginal Treatment

All of the marginal areas infested by the young hoppers should be treated. An inspection should be made before treatment to determine the infested area and the spray should be applied so as to include all these areas. Young hoppers are very small, so a close inspection of the ground should be made to check for infestation.

In every case, the bulletin advises, it is beneficial to check throughout the fields to make certain that all pests are destroyed. Many later problems will be eliminated if proper marginal treatment is carried out at the right time.

Immediate application of the proper insecticide is important for control of the grasshopper, especially in the case of migratory grasshoppers. Although these are not expected to occur in Montana this year, such flights are not uncommon and may occur despite predictions to the contrary. The flights usually occur in the wheat areas when the crop is maturing and the insects in these flights can clip a high percentage of heads in a short time. For control in this situation, the Montana entomologist recommends two ounces of aldrin per acre.

Aldrin for Dry Foliage

In cases of dry foliage, so common during the period of drought suffered this season, only aldrin should be used at the two-ounce per acre rate. Application should be made when the grasshoppers are up on the plants and exposed so as to insure direct contact of the spray on the pests.

In most cases it should not be necessary to apply control measures against grasshoppers this time of year to protect newly seeded winter wheat, because control should have been attained earlier, but the two-ounce per acre application of aldrin is recommended if necessary. ◆

. . . Phosphorus Accumulation

(*Continued from page 41*)

increased the available P in the soil (last column, Table 3), and with the exception of the no-fertilizer plots, all soil phosphorus tests from the other treatments are in the range which is classified by New York agronomists as "very high," (Table 4). After five years of the high rate of application, available phosphorus in the soil was up to seventy-five pounds per acre, (Figure 2).

The accumulation of available phosphorus which was found in this and other experiments immediately leads one to ask:

(1) how widespread is phosphate accumulation? and

(2) on the basis of accumulation, can we narrow our fertilizer ratios accordingly?

Soils used in the Geneva experiment are classified as Honeoye and Ovid silt loams. Honeoye is moderately well-drained while Ovid is imperfectly drained. Both are formed from alkaline glacial drift composed of limestones, sandstones, shales and crystallines. Soils of similar type are common throughout the principal canning crop areas of western New York, which roughly includes all of the state lying south of Lake Ontario with the exception of the southern tier of counties along the Pennsylvania border.

Soils of similar physical properties are common in large areas of the northeast, and when adequately limed will approximate those used in this experiment in chemical characteristics. Thus, it seems that similar results would be expected on other heavily fertilized soils in the northeast.

Phosphorus Accumulation

The soil testing laboratory at Cornell has interesting data on the extent of soils testing high and very high in available phosphorus. In 1950, for example, 31 per cent of all soil samples received from typical New York vegetable farms (excluding peat and muck samples and potato soils from Long Island) exceeded 20 pounds available P per acre, while an additional 21 per cent fell in the range of 10 to 20 pounds per acre. More than half of the soils tested were in the range where little or no response to phosphorus fertilizers can be expected.

From typical dairy farms, on the other hand, only six per cent of the samples exceeded 20 pounds per acre, while seven per cent were in the range of 10 to 20 pounds per acre. Of the vegetable soils 48 per cent contained less than 10 pounds per acre, while 87 per cent of the dairy farm samples were below 10 pounds.

Narrower Ratios

It is apparent that the present trend in New York and other states toward narrower $N\text{-}P_2O_5\text{-}K_2O$ ratios is justified. Thirty years ago New York growers used large quantities of "acid phosphate", or 0–18–0. Gradually, small amounts of nitrogen and potash were added to give such analyses as 4–16–4, 4–12–4, 3–12–6, and 4–12–8.

In view of the phosphorus accumulation, it now appears that on the heavier soils the 1–4–1 and 1–3–1 ratios may, and should, be replaced by 1–2–1 (8–16–8) and 1–1–1 (10–10–10) ratios; while on the lighter or sandier soils, the 1–4–2 and 1–3–2 may be replaced by the 1–2–2 (8–16–16) ratio. In all cases, equivalent amounts of nitrogen should be applied so that only the phosphorus application is reduced when using the narrower ratio analyses.

At present, therefore, the only ratios recommended in New York for vegetable canning crops to be grown on adequately limed and previously heavily fertilized mineral soils are the 1–1–1, the 1–2–1 and the 1–2–2, and it seems quite possible that similar recommendations would apply to many acres of soils in the east and northeast.

Because of the very serious shortage of sulfur and superphosphate, any narrowing of mixed fertilizer ratios at this time will help spread out the limited supplies of superphosphate. ◆

NFA Will Inform Banks About Loans

National Fertilizer Association has begun a program to furnish the nation's banks with information regarding farm production loans involving fertilizers.

Russell Coleman, NFA president, pointed out that additional working capital will be needed by farmers to meet the U. S. Department of Agriculture's crop goals. On the basis of present production costs, farmers by 1955 will need about $700 million more working capital for fertilizers alone than they used in 1950. NFA's aim is to make private banks aware of this prospective increase so that they can prepare to obtain or increase their share of this agricultural business.

Dr. Coleman reports enthusiasm among bankers thus far approached. They want to know what fertilizer usage means in terms of dollars and cents. NFA is distributing this information collected by staff members from state colleges of agriculture.

Industrial News

Potash Deliveries Break Record in North America

Potash deliveries in North America reached a record total of 1,755,140 tons K_2O during the fiscal year ended May 31, according to the American Potash Institute. This represents a seven per cent increase over 1950–51. Deliveries by the six leading American Potash producers were well over any previous year and those of imported potash were higher than last year. Deliveries were made in 44 states, the District of Columbia, Puerto Rico, Cuba, Hawaii, Canada and other countries.

U. S. Deliveries

Deliveries for agricultural purposes in the continental United States amounted to 1,547,323 tons K_2O, a nine per cent increase over last year. Canada received 61,508 tons K_2O, an increase of one per cent; Cuba, 17,616 tons, a 42 per cent increase; Puerto Rico, 23,491 tons, a decrease of 22 per cent; Hawaii, 14,173 tons, an increase of three per cent; and other countries, 10,083 tons, a 19 per cent decrease compared to last year.

Illinois was the leading state for deliveries, followed by Ohio, Georgia, Virginia and Indiana. Deliveries do not necessarily correspond to consumption in a given state.

Muriate Main Grade

Comprising 77 per cent of the total agricultural potash delivered, 60 per cent muriate of potash continued to be the principal grade. Sulfate of potash and sulfate of potash magnesia made up seven per cent of deliveries; 50 per cent muriate of potash 15 per cent; while manure salts dropped to less than one per cent, reflecting the trend toward the use of more concentrated materials.

Deliveries of potash for chemical uses amounted to 80,947 tons K_2O, a decrease of eight per cent under 1950–51. The 60 per cent muriate grade made up 95 per cent of chemical deliveries, and sulfate of potash five per cent.

New Officer

H. C. Davis

Officers named at the Industrial Bag & Cover Association's annual meeting included H. C. Davis, manager of Bemis Bro. Bag Company's Paper Specialty Plant, St. Louis, president; S. G. Yount, president of Southland Paper & Converting Co., Los Angeles, vice-president; and P. O. De'tsch, New York City, secretary, treasurer and administrative officer.

Japan Plans to Export 46,000 Tons of Sulfur

Sulfur-hungry superphosphate manufacturers will have a chance at buying 46,000 tons of sulfur to be exported from Japan the latter half of 1952.

For the first half of 1952, the Japanese government had agreed to export 11,000 tons of sulfur under IMC allocation, but exports exceeded this figure. The amount in excess of 11,000 tons will be included in export allocations for the second half of the year.

Progress in increased production and decline in consumption by synthetic textile manufacturers were factors, according to official sources, which caused marked increase in the export allocation. They said Japan's monthly production rate is 15,000 tons, but total production for the financial year ending March 31, 1953, will reach 220,000 tons.

Dieldrin Approved for Outdoor Insect Control

Dieldrin has been approved by the U. S. Department of Agriculture for outdoor control of adult houseflies, mosquitoes and certain other insect pests, according to F. W. Hatch, manager of Julius Hyman and Co. division, Shell Chemical Corp. One application lasts several weeks in areas exposed to the weather and for several months in protected areas.

Hatch, in announcing USDA's acceptance of the dieldrin label, explained new techniques for housefly control in New York and adjoining states. One is the "strip method" used in dairy barns and other farm buildings where chemical controls of this nature could not heretofore be used.

In this method, strips of fine mesh screen are immersed in a dieldrin solution, removed and dried overnight. The strips then are fastened at spacings on surfaces which have been found attractive to flies, such as door entrances and ceilings. Because flies tend to grasp a screen surface, they literally embrace the poison, giving it the best possible chance to work. A marked reduction in fly population may be noted within 24 hours, and treated strips are effective for several weeks, according to the company. At the end of this time they can be removed and retreated, if necessary.

California Gets Fund

A gift of $2,500 for a combination student loan fund-scholarship fund has been made to the Kellogg-Voorhis campus of California State Polytechnic College.

The money was presented by Pest Control Operators of California in memory of the late Chet Pencille, pioneer in the pest control industry. Presenting the funds was Wayne K. Davis of Berkeley, president of PCO.

California Polytechnic was chosen as the recipient of the fund because of the pest control program the college offers within its services and inspection major.

Industrial News

9-2 Stauffer Chemical Catalog

Data on Stauffer Chemical Co. products and numerous tables on specific gravity, viscosity, specific heat, solubility and other properties are included in Stauffer's revised 112-page general catalog. Covering basic chemicals for industry and agriculture, the illustrated catalog will give valuable assistance to farm chemicals users. For further information on Stauffer products, fill out a **Reader Service** card, using number **9-2.**

Nitrogen Advisory Group Makes Recommendations

Maximum favorable consideration should be given to applications for rapid tax amortization of the nitraphosphate portion of integrated ammonia-nitrophosphate facilities, according to a recent recommendation by the nitrogen industry advisory committee to the National Production Authority.

The committee opposed rapid amortization for ammonia producing facilities which might be constructed in connection with such integrated nitraphosphate plants if ammonia facilities to be built exceed the authorized expansion goal.

When asked by NPA whether the present 2,930,000 tons nitrogen expansion goal set for 1955 is sufficient to meet requirements in all areas, individual committee members painted the following picture:

No Shortage

1. No nitrogen shortage will exist east of the Rocky Mountains in 1955.

2. Demand for nitrogenous fertilizer on the west coast will be 200,000 tons annually by 1955, with available supplies at 238,000 tons: 188,000 tons local capacity, and 50,000 tons imported from Canada. Agricultural requirements data indicate a potential shortage of 35,000 tons in this area.

3. On the Gulf Coast, a near term shortage of direct application liquid ammonia is to be expected because demand for this type of nitrogen fertilizer material is increasing and is expected to expand beyond previous estimates.

4. However, when new facilities come into production ample ammonia will be available throughout the Gulf Coast and southeast areas.

Sees Overproduction

Potential overproduction of approximately 200,000 tons of nitrogen nationally by 1955 was the estimate of one committee member. He urged the industry to cooperate with the Department of Commerce and land grant colleges in promoting expanded use of nitrogenous fertilizer and developing potential markets for nitrogen among the nation's farmers.

Imperial Cuts Production

Imperial Chemical Industries has announced a 25 per cent cut in sulfate of ammonia production at its Billingham-on-Lees plant, one of the biggest synthetic fertilizer and heavy chemical plants in the United Kingdom. Seasonal falling off and foreign competition were reasons given.

The company said estimated sales of new organic products such as acetone are not being achieved because of the trade slump in the plastics and paint industries. Thus far laborers have been transferred to other I.C.I. plants. The company's manager said production cuts are not panic measures, but "a prudent balancing of production with expected sales."

Japanese Seek Aid

Financial assistance is being asked for Japanese superphosphate producers by the Ministry of International Trade and Industry. The Bank of Japan is contemplating a $10 million loan to help the industry.

Stockpiles of 225,000 tons are the result of overproduction as the result of MITI's generous estimates of demand.

Industrial News

USDA Changes Regulations For Pesticide Distribution

Two proposals for changes in U. S. Department of Agriculture regulations governing distribution of pesticides have been made by the government agency. Interested persons have until Sept. 15 to submit comments.

USDA supervision of the methods and quantities of pesticides used in testing experimental products and requirement of an ingredient statement on the label of each new poison are proposed.

USDA would also like to renew registrations at the end of five years. The Insecticide, Fungicide and Rodenticide Act requires cancellation of registrations after five years. Many registrations will expire shortly after December, since the act became effective in December 1947.

This proposal permits a registrant to apply for a five-year renewal of his registration when the original one expires. USDA says it will notify each registrant of the expiration date of his listing.

Lodge Retires

Fred S. Lodge, National Fertilizer Association secretary and treasurer and former acting president, retired recently after 18 years with NFA.

He joined Armour & Co. upon graduation from University of Illinois in 1908. He rose from chemist to assistant director of manufacturing.

Hihn Joins Executive Staff of John Powell

M. Morrison Hihn, chemical engineer, has joined the executive staff of John Powell & Co., Inc.

Hihn, a native of Baltimore, Md., is a graduate of Johns Hopkins University. Formerly with American Can Co., Hihn was involved as research engineer in projects dealing with special insecticide-packaging problems.

His assignments at Powell have not as yet been announced.

To Speak at Safety Meeting

J. L. Rosenstein

T. J. Clarke

The National Safety Council's Fertilizer Safety Section has completed plans for its 1952 program at the National Safety Congress in Chicago, Oct. 20–24.

Speakers on Oct. 22 will include J. L. Rosenstein, Head of Dept. of Psychology, University of Miami, "Why Safety"; "Multiple Shot Blasting in Fertilizer Storage" by Mark Withey, Trojan Powder Co. explosive expert and G. G. Blair, Ebasco Services, Inc. fire prevention engineer. Withey will demonstrate multiple shot blasting and will discuss the topic during the afternoon session. Blair will speak on "Fire Prevention in Fertilizer Plants through Maintenance."

Other talks to be given Oct. 23 include "1953 Goals for Fertilizer Section," John E. Smith, Spencer Chemical Co. safety director; "Housekeeping in Fertilizer Plants," E. O. Burroughs Jr., Manager, Insurance Dept., F. S. Royster Guano Co.; "Gas and Dust Control," Herbert Walworth, Lumberman Mutual Casualty Co. and "How to Conduct a Safety Meeting," T. J. Clarke, Grange League Federation Personnel Manager.

Clarke has spent 16 years with G. L. F. in various capacities, interrupted by military service in World War II.

A graduate of Pace College and Cornell University in business administration and engineering, Clark also studied cooperative management at University of Massachusetts.

In his present capacity, he serves on a consulting basis for the company's safety problems.

Dr. Rosenstein, a graduate of Lafayette College and the University of Pennsylvania, received his Ph.D. from Indiana University in the field of clinical and applied psychology. He has served on the faculties of Indiana University and Butler University and the staff at the H. H. Young Foundation for Research in Clinical Psychology. He is now an industrial psychologist and professor in the Department of Management, Loyola University, Chicago.

McGraw-Hill has published two of his books, "Psychology of Human Relations for Executives" and "Scientific Selection of Salesmen." He has written a series entitled "Human Side of Safety" for the National Safety Council, as well as aiding in the production of safety films for the Council.

. . . Continuous Mixer

(*Continued from page 32*)

stopped operation. Therefore the mixer of Figure 1, which has four acid inlets welded into the cone sides 3¾ inches above the discharge extension, was built.

To aid further in spreading the acid over the surface of the cone the size of the openings in the acid inlets was reduced so that the acid emerged from the inlets at a velocity of 11.9 feet a second.

Satisfactory continuous operation of the mixer for 55-minute periods was obtained but longer tests could not be made because of limited storage space for acid and dust. Analyses of normal superphosphates made with this mixer are given in Table I. The first three samples in the table were taken from batches of product allowed to solidify in the den, and the second three from batches which solidified on the belt and were disintegrated and cured for 14 days at 135° F. in the wooden bins.

Citrate-insoluble P_2O_5 contents of the pile-cured superphosphates are approximately equivalent to those calculated from the nomographs of Shoeld et al. (3) for the same mixtures after being cured for 30 days. It is apparent that the mixing of the acid and rock phosphate was thorough.

It is believed these results demonstrate the feasibility of using a funnel-type continuous mixer in the manufacture of normal superphosphate.

Tests Needed

Data obtained in this work indicate, in general, the proportions of a commercial-scale mixer for this purpose; the design factors that would determine exactly the size and the shape of a mixer for a specific commercial production rate have not been defined. Tests with large mixers are needed. The Tennessee Valley Authority does not plan to make such tests because it does not have a plant for manufacturing normal superphosphate. The mixer is so simple in design that large-scale tests should not be costly.

A funnel mixer should cost considerably less initially and be less expensive to maintain than mechanical continuous mixers now being used. Use of a funnel mixer as a replacement for a batch mixer would involve installation of equipment for feeding acid and rock phosphate at controlled rates, but operative labor should be reduced and product quality and uniformity might be improved. ◆

REFERENCES

1. Bridger, G. L., Wilson, R. A., and Burt, R. B. Ind. Eng. Chem. *39*, 1265 (1947).
2. Harvey, S. A., and Bridger, G. L. U. S. Patent 2,528,514. November 7, 1950.
3. Shoeld, M., Wright, E. H., and Sauchelli, V. Ind. Eng. Chem. *41*, 1334 (July 1949).

Davison Building Triple Super Plant in Florida

Construction by Davison Chemical corporation of a triple superphosphate plant has begun at Ridgewood, Fla. The plant, which will be completed in October, 1953, marks Davison's entry into the triple superphosphate field.

Operation of the Ridgewood unit will add 250 to the payroll of approximately 500 now maintained by Davison's Phosphate Rock division, under Dr. Allan T. Cole, manager. The plant is part of a $25,400,000 expansion program. Another major project is a plant for production of petroleum cracking catalyst at Lake Charles, La.

Rising costs of fertilizer production were cited by company officials as the reason for entry into this field.

The factory will produce sulfuric acid. The Dorr Process for triple superphosphate production will be used. Dorr Co., Stamford, Conn., is architect for the plant.

Deere Buys Land

Deere & Co. has purchased a total of 500 acres of land in Pryor, Okla. A recent purchase of 180 acres adjacent to the original 320 acre tract was made, according to company officials, to handle operations of the proposed plant.

Selden Promoted

J. M. Selden has been appointed manager of the Eastern Division of Shell Chemical Corp., according to Jan Oostermeyer, company president.

A native of Pittsburgh, Pa.,

J. M. Selden

Selden served as vice-president and director of R. W. Greeff & Co., agents until 1946 for the sale of Shell products east of the Rockies, then as sales manager of the firm's Eastern Division.

New Cotton Defoliant

Production of chlorate cotton defoliant in extensive new facilities at its New Orleans Works in Marrero, La., has been started by General Chemical Division, Allied Chemical & Dye Corp.

Distributors in the cotton belt already have stocked quantities large enough for growers to obtain the benefits of defoliation on early cotton.

The chlorate cotton defoliant is a highly soluble spray powder, containing 40 per cent chlorate, which has been especially formulated for application either by airplane or by ground sprayers, according to the company. It is available in 100-pound drums.

Because it is effective under either dry or wet conditions, the defoliant has special advantage for the cotton area. It is effective even in very dry areas because the spray itself provides the moisture needed for effective defoliation.

Industrial News

Sulfuric Acid Production May Fall Below Estimate

The sulfur shortage probably will cause the sulfuric acid industry to fall behind estimated 1955 demands of 19.5 million tons.

The industry advisory committee expressed this view at a recent meeting with the National Production Authority. The committee reports, however, that the outlook is better now than in January. Order M-94, said the committee, now should be revoked. The order restricts non-defense users of the acid to 90 per cent of amounts used in 1950.

Aries Opens Regional Office in San Antonio

R. S. Aries & Associates, chemical engineers and economists, have announced establishment of a regional office in San Antonio to satisfy increased demands for services in the Southwest. The office will coordinate Aries consulting work in the area.

Appointed head of the Texas office was Alden H. Waitt, company vice-president. General Waitt is a graduate of Massachusetts Institute of Technology and retired head of the Chemical Warfare Service. He has served Aries since February, 1950, as Washington representative.

British Start Agency

With the end of government control of fertilizers in Britain comes Phosphate Rock agency, a company with a membership composed of all British users of phosphate rock for agricultural purposes.

Stewart's Disease Spreads

Studies of Stewart's disease or bacterial wilt of corn in Illinois this year indicate that it will occur much farther north and be much more destructive in Illinois than it was in 1951.

Stewart's disease produces two principal types of damage: an early season wilt and death of plants, especially in sweet corn, and late season leaf blight, which may be severe enough to cause death of plants on both sweet and field corn. The wilt and leaf blight phases of the disease are expected to appear on susceptible varieties of corn in Illinois in 1952.

Extreme northern areas will have little or no trouble. Northern sectors will experience light to moderate late season blight. Damage in central areas will be light to moderate early in the season, and moderate to severe in the late season. Severe damage can be expected in the southern section both from early season wilt and late season leaf blight.

Control of Mosaic

Mosaic, a tobacco disease, can be reduced considerably by fall plowing or by crop rotation, according to Dr. Paul J. Anderson, head of the Windsor Tobacco Laboratory, Connecticut Agricultural Experiment Station.

Causing the disease is a virus that lives from one crop to that of the next year in crop residues left in or on the soil. When these residues decay thoroughly, the virus is destroyed.

Mexico Will Exploit Its Mining Facilities

The Mexican Government has been urged to amplify exploitation of its mining resources, according to a study made by the Union of Miners, Metallurgists and Allied Trades. The report states that until now attention has been given only to development of gold and silver mines, while other metals of equal importance have been completely neglected.

Apart from metals, the report urges that special attention be given to intense mining of nitrates, to advance Mexico's fertilizer industry.

Government aid is advocated as a measure to step up production of industrial metals and minerals with urgent, immediate attention being given to the needs of agriculture. The report will receive study by government authorities although it is doubtful action will be taken until the new administration takes office next year.

Tax Tag Sales Show Rise

Reports from 10 southern and midwestern states giving fertilizer tax tag sales and reports of fertilizer shipments recorded an aggregate 259,000 short ton increase—from 656,000 tons in May, 1951 to 915,000 tons in May, 1952, according to National Fertilizer Association.

Tag sales and shipment reports in 13 states for the first four months of 1952 show a five per cent increase over the corresponding period a year ago—from 5.8 million tons in 1951 to 6.1 million tons for 1952.

Industrial News

New forage pest . . .

United States Pest Survey

State pest surveys for the period from mid-July to early August were highlighted by a California letter reporting discovery of a new forage crop insect. The new pest, a casebearer, is related to the cigard and pistol casebearers which cause some damage to apples and pears in eastern areas.

A native of Europe, the insect is found on clover fields in New Zealand and was discovered in clover fields of the Sacramento valley late in July. Surveys have shown the area of infestation to extend from Wheatland, Yuba county, to Galt, Sacramento county, and to Willows, Glenn county.

Possible damage which may result from infestations of the pest has not yet been determined although damage apparently is confined to the seed crop.

One grower in the area treated infected plots with TEPP methoxychlor, parathion, and DDT. Counts showed a significant number of larvae only in the parathion treated block.

CEREAL AND FORAGE INSECTS

Activity of the **European Corn Borer** is reported on the increase in Mass. and Md., with entomologists in Mass. expecting a heavy infestation. Weather has caused a reduction in numbers in Ill. and Kan.

In Iowa the first brood population was low in most areas but later reports indicate a relatively heavy infestation in the northern three tiers of counties. Minn. expects the largest second generation development since 1949.

The **corn rootworm** and **southern corn rootworm** have caused considerable damage in Kan. Destruction by these pests has been extremely heavy in comparison with other corn insects.

Many areas term the **corn earworm** infestation higher than usual. In Mass. injury is slightly more severe than last year; Ill. expects infestations to get progressively worse; Okla. sorghums are affected and the Utah population is serious.

Lygus bug populations have been building up in alfalfa and clover fields of southern Idaho. Many seed fields in that state have been treated. Utah and Colo. report damage to alfalfa seed fields in some areas; the pests are heavy on Wyom. alfalfa and on legumes in Tenn. Moderate infections exist on corn, cotton and tobacco in local Tenn. areas.

Alfalfa, red and ladino clover and birdsfoot trefoil fields in New York have been severely injured by the **potato leafhopper.** Western Ohio also has a very heavy infestation in alfalfa fields.

VEGETABLE INSECTS

Several states have noted the increased activity of spidermites on vegetable crops. Included are potatoes, sugar beets and peppermint in the Prosser area of Wash., lima beans (two-spotted mite) in Cal., Va. tomatoes and soybeans.

Cabbage worms have been quite heavy in a number of areas. Severe injury to cabbage by the imported cabbageworm has been noted in both Del. and Neb. Cabbage loopers are light to mod-

Industrial News

erate on kale in eastern Va. but have badly damaged Ohio in one location.

The **black bean aphid** is termed the most threatening pest of limas in Del. and its population is building up. At least one large field of limas in Cal. has been severely infested by the insect.

Various **leafhoppers** are abundant in many areas. Information received to date shows them to be present in "cloud" numbers on lettuce in much soil of Wayne county N. Y. and destructive on virtually all crops in Niagara county; abundant on beans and lettuce in Mass.; damaging beans in Ohio; very abundant on celery (six-spotted leafhopper) in Salt Lake county, Utah fields; and heavy on black eyed peas (potato leafhopper) near Georgetown, Del.

FRUIT INSECTS

Spider mites seem to be the current outstanding fruit pest throughout the country. European red mites are building up in Conn.; mite control continues a major problem in N. J. peach and apple orchards; leaf bronzing caused by the European red and two-spotted mites has been noted in a number of Ind. orchards; and Mo. terms mites a problem throughout the state.

Two states, Ohio and Utah report that the mites have not been as damaging as usual.

COTTON INSECTS

An unexpected spread of the **cotton leafworm** has been found in N. M. with new infestations occurring in widely separated areas. Control measures for the pest may be required in Tex. fields.

The **bollworm** situation is both good and bad in various sections. A slight decrease in damage has been noted in Tenn. and Ark. terms conditions good.

However, increased activity has been noted in N. C., La., Okla., N. M. and Ariz. Ariz. says the bollworm is at present the most threatening pest.

Infestations of the **boll weevil** generally are low but some heavy spots have been found in Tex., Okla., Ga. and other states. A slight increase is reported in Okla., and a considerable increase in north central, north east and eastern Tex. with serious damage in some areas.

Infestations have been reported in 28 N. C. counties but Tenn. terms the situation good and in Ark. numbers still are under the danger point although a slight rise has been noted in most fields. Infestations continue to increase in S. C.

Pink bollworms have been found in gin trash in two Tex. counties. The occurrence is reported as 30 times heavier than in 1951.

Infestations of **spider mites** continue high in southern Ga., Miss. and the San Joaquin Valley area of Cal. Light infestations are reported from western Tenn.

Lygus bug populations in N. M. are large enough to do some damage in several areas.

Italian Sulfur Production For '52 Seen Increasing

Italy's sulfur output this year will be 215,000 tons of melted from 1,750,000 tons of ore, according to a recent estimate made by the Italian Sulfur Board. The yield should be equal to that of 1950, and somewhat above the 1951 figures (1,612,428 tons of ore with a yield of 200,478 tons of sulfur).

Forecasts for output of melted sulfur in future years are optimistic. By 1954 output should reach the pre-war level of 400,000 tons.

This year will show first results of the industry's research and development programs. In addition, stability of prices at rather high levels and strong demand from Europe has induced producers to make new efforts to increase mining output. Research work, costing 950 million lire, will be terminated within the three year period 1952–54.

USDA Amendments Would Bar Bone Meal Importation

Recently recommended USDA amendments would prohibit importation of raw bone meal for use as fertilizer or feed.

Only bone meal which in the normal process of manufacture has been heated under a minimum of 20 pounds of steam pressure for at least an hour at a temperature of not less than 250° F. could be imported.

Purpose of the new regulations is to reduce possibility of introducing anthrax into the United States. During the first quarter of 1952, 395 outbreaks of anthrax were reported in five midwestern states.

Buyers' Guide

Classified Index to Advertisers in 'Farm Chemicals'

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Bailey & Lerch, Washington, D. C.

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Ashcraft-Wilkinson Co., Atlanta, Ga.
Gen. Chem. Div., Allied Chem. & Dye, N. Y. C.

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Mathieson Chem. Corp., Baltimore, Md.
Nitrogen Div., Allied Chemical & Dye Corp., N.Y.C.
Phillips Chemical Co., Bartlesville, Okla.
Spencer Chemical Co., Kansas City, Mo.

AMMONIUM NITRATE
Ashcraft-Wilkinson Co., Atlanta, Ga.
Lion Oil Co., El Dorado, Ark.
Phillips Chemical Co., Bartlesville, Okla.
Spencer Chemical Co., Kansas City, Mo.

AMMONIUM PHOSPHATE
Monsanto Chem. Co., St. Louis, Mo.

AMMONIUM SULFATE
See Sulfate of Ammonia

BAGS—Burlap
Bemis Bros. Bag Co., St. Louis, Mo.
Mente & Co., Inc., New Orleans, La.
Virginia-Carolina Chemical Corp., Richmond, Va.

BAGS—Cotton
Bemis Bro. Bag Co., St. Louis, Mo.
Mente & Co., Inc., New Orleans, La.
Virginia-Carolina Chemical Corp., Richmond, Va.

BAGS—Multiwall-Paper
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Kraft Bag Corporation, New York City
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Ashcraft-Wilkinson Co., Atlanta, Ga.
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Mente & Co., Inc., New Orleans, La.

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Schmutz Mfg., Louisville, Ky.

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Atlanta Utility Works, The, East Point, Ga.
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Stedman Foundry and Machine Co., Aurora, Ind.

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Ashcraft-Wilkinson Co., Atlanta, Ga..
Commercial Solvents Corp., New York City
Gen. Chem. Div., Allied Chem. & Dye, N. Y. C.

BONE PRODUCTS
American Agricultural Chemical Co., N. Y. C.
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BUCKETS—Hoist, Crane, etc.
Hayward Company, The, New York City

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Woodward & Dickerson, Inc., Philadelphia, Pa

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Ashcraft-Wilkinson Co., Atlanta, Ga.
Gen. Chem. Div., Allied Chem. & Dye, N. Y. C.
Monsanto Chemical Co., St. Louis, Mo.

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Ashcraft-Wilkinson Co., Atlanta, Ga.

DILAN
Commercial Solvents Corp., New York City

DILUENTS
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Chemical Construction Corp., New York City
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Stedman Foundry and Machine Co., Aurora, Ind.
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American Agricultural Chemical Co., N. Y. C.
Armour Fertilizer Works, Atlanta, Ga.
Davison Chemical Corporation, Baltimore, Md.
International Min. & Chem. Corp., Chicago, Ill.
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Virginia-Carolina Chemical Corp., Richmond, Va

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Ashcraft-Wilkinson Co., Atlanta, Ga.

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American Agricultural Chemical Co., N. Y. C.
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Gen. Chem. Div., Allied Chem. & Dye, N. Y. C.
Tennessee Corp., Atlanta, Ga.

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Lion Oil Company, El Dorado, Ark.
Monsanto Chemical Co., St. Louis, Mo.

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Gen. Chem. Div., Allied Chem. & Dye, N. Y. C.
Lion Oil Company, El Dorado, Ark.

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Andrews Sales, Inc., W. R. E., Philadelphia, Pa.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Commercial Solvents Corp., New York City
Milligan Bros., Jefferson, Iowa
Gen. Chem. Div., Allied Chem. & Dye, N. Y. C.
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National Lime & Stone Co., Findlay, Ohio

LOADERS—Car and Wagon
Sackett & Sons Co., The A. J., Baltimore, Md.

Monsanto Ups Capacity

Monsanto Chemical company has increased its capacity to produce phosphoric acid, ammonium phosphates and potassium phosphates for use in formulating liquid and water soluble fertilizers.

The Monsanto products, sources of nitrogen, phosphorus and potash are liquid 75 per cent phosphoric acid and crystalline mono-potassium phosphate, diammonium phosphate and monoammonium phosphate.

For Sale

For sale, 1 Special Heavy Duty Stedman Bagger including superstructure electrical equipment, Two each Bag Conveyors, Union Special Sewing Machines and Stands and Exact Weight Scales. Also Chattanooga Buggies, Toledo Floor Scales, 1 – 40 ft. Shuttle Conveyor, 1 – 120 ft. Trough Belt Conveyor. For prices contact Lange Brothers, Inc., No. 1 Angelica St., St. Louis 7, Missouri.

Industrial News

Shell Chemical Plans Centralization in Denver

Shell Chemical Corporation will centralize its agricultural chemical activity in Denver, according to Jan Oostermeyer, company president.

Shell recently purchased the Denver firm of Julius Hyman & Company, which now is Julius Hyman & Company Division. Manufacturing and research activities currently are established at the Rocky Mountain Arsenal plant nearby. All Shell agricultural products except fertilizers will be marketed from Denver.

F. W. Hatch was appointed vice-president of Julius Hyman and manager of the new division. He has long been associated with farm chemicals and is identified with aldrin and dieldrin, products made by Julius Hyman.

Other appointments to the new sales organization include L. F. Stayner, formerly of the New York sales staff, to sales manager of Julius Hyman & Company Division.

P. E. Joyce heads an Export Sales and Development Department, located in New York, and responsible for the development of markets for Shell agricultural chemicals abroad.

W. E. McCauley, formerly of Julius Hyman, will serve as Manager of the Product Development Department of the new division, with L. G. Smith, of Shell's New York Agricultural Products Department, as his assistant. The Technical Service Department will be managed by L. Sykken, formerly with Shell Development Company of California, with M. M. Rosson, of Shell Chemical's New York offices as assistant manager.

3-12-6 May Be Dropped

North Carolina will discontinue 3–12–6 fertilizer next year, should the state Board of Agriculture follow the recommendation of a recent public hearing in Raleigh. That would leave only 20 official fertilizer grades for next year. At one time there were 500 grades sold in the state.

. . . Safety

(*Continued from page 37*)

the story of the old Greek who had several sons who went out into the world. Each son as well as the father was attacked by their enemies and was unable singly to defend himself. Finally all of the sons returned to their home. The father selected a stick for each son and told him to break the stick. Each son easily broke his stick. Then the father took the same number of sticks and bound them together and gave them to each son but none could break the bundle of sticks. The father then said, '*Singly we are vulnerable but united and bound together we are stronger than our enemies.*' ".

Now is the time for the fertilizer industry to bind together and unite to exert a concentrated effort, nation-wide, to eliminate the causes of industrial accidents and fires. The National Safety Council which supplies services on a national basis now is transmitting the fertilizer news letter and will also print and transmit data sheets and accident statistics when they are developed. We urge non-members to join the National Safety Council and do their part in supporting this very worthwhile movement which will result in mutual benefits. Present records, which are excessively high, were not developed overnight and neither will the corrections of the conditions which caused them to be accomplished in a similar period. We have a big and time consuming job ahead of us which must have the firm support of top management from all sections of the country. ◆

Chase Wins Safety Award

Chase Bag Company's Reidsville, N. C. plant recently was awarded a safety award after completing 386,781 man-hours without an accident. Officiating at the ceremony were R. N. Conners, company Vice-President and General Sales Manager, and Commissioner Forest H. Shuford, U. S. Department of Labor.

Buyers' Guide

Classified Index to Advertisers in 'Farm Chemicals'

MACHINERY—Acid Making and Handling
Atlanta Utility Works, The, East Point, Ga.
Chemical Construction Corp., New York City
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Machine Co., Aurora, Ind.

MACHINERY—Acidulating
Chemical Construction Corp., New York City
Sackett & Sons Co., The A. J., Baltimore, Md.

MACHINERY—Ammoniating
Sackett & Sons Co., The A. J., Baltimore, Md.

MACHINERY—Grinding and Pulverizing
Atlanta Utility Works, The, East Point, Ga.
Bradley Pulverizer Co., Allentown, Pa.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Machine Co., Aurora, Ind.

MACHINERY—Material Handling
Atlanta Utility Works, The, East Point, Ga.
Hayward Company, The, New York City
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Machine Co., Aurora, Ind.

MACHINERY—Mixing, Screening and Bagging
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Machine Co., Aurora, Ind.

MACHINERY—Power Transmission
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Machine Co., Aurora, Ind.

MACHINERY
Superphosphate Manufacturing
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Machine Co., Aurora, Ind.

MANGANESE SULFATE
McIver & Son, Alex. M., Charleston, S. C.
Tennessee Corp., Atlanta, Ga.

MANURE SALTS
Potash Co. of America, New York City

MINOR ELEMENTS
Andrews Sales, Inc., W. R. E., Philadelphia, Pa.
Tennessee Corporation, Atlanta, Ga.

MIXERS
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Machine Co., Aurora, Ind.

NITRATE OF SODA
American Agricultural Chemical Co., N. Y. C.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Nitrogen Div., Allied Chemical & Dye Corp., N.Y.C.
International Min. & Chem. Corp., Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Woodward & Dickerson, Inc., Philadelphia, Pa.

NITROGEN SOLUTIONS
Nitrogen Div., Allied Chemical & Dye Corp., N.Y.C.
Carnegie Chemical Mfg. Co., Los Angeles, Cal.
Lion Oil Company, El Dorado, Ark.
Phillips Chemical Co., Bartlesville, Okla.
Spencer Chemical Co., Kansas City, Mo.

NITROGEN MATERIALS—Organic
American Agriculture Chemical Co., N. Y. C.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
International Min. & Chem. Corp., Chicago, Ill.
Jackle, Frank R., New York City
McIver & Son, Alex. M., Charleston, S. C.
Woodward & Dickerson, Inc., Philadelphia, Pa.

NOZZLES—Spray
Monarch Mfg. Works, Philadelphia, Pa.
Spraying Systems Co., Bellwood, Ill.

PARATHION
Ashcraft-Wilkinson Co., Atlanta, Ga.
Gen. Chem. Div., Allied Chem. & Dye, N. Y. C.
Monsanto Chemical Co., St. Louis, Mo.

PENTACHLOROPHENOL
Monsanto Chemical Co., St. Louis, Mo.

PHOSPHATE ROCK
American Agricultural Chemical Co., N. Y. C.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
International Min. & Chem. Corp., Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Virginia-Carolina Chemical Corp., Richmond, Va.
Woodward & Dickerson, Inc., Philadelphia, Pa.

PHOSPHORIC ACID
American Agricultural Chemical Co., N. Y. C.
Gen. Chem. Div., Allied Chem. & Dye., N. Y. C.
Monsanto Chemical Co., St. Louis, Mo.
Virginia-Carolina Chemical Corp., Richmond, Va.

PLANT CONSTRUCTION—Fertilizer and Acid
Atlanta Utility Works, The, East Point, Ga.
Chemical Construction Corp., New York City
General Industrial Development Corp., N. Y. C.
Monsanto Chemical Co., St. Louis, Mo.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Machine Co., Aurora, Ind.
Titlestad Corporation Nicolay, New York City

POTASH—Muriate
American Potash & Chemical Corp., N. Y. C.
Ashcraft-Wilkinson Co., (Duval Potash) Atlanta, Ga.
International Min. & Chem. Corp., Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Potash Co. of America, New York City
Southwest Potash Corp., New York City
United States Potash Co., N. Y. C.

POTASH—Sulfate
American Potash & Chemical Corp., N. Y. C.
International Min. & Chem. Corp., Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Potash Co. of America, Washington, D. C.

POTASSIUM PHOSPHATE
Monsanto Chemical Co., St. Louis, Mo.

PRINTING PRESSES—Bag
Schmutz Mfg. Co., Louisville, Ky.

PYROPHYLLITE
Ashcraft-Wilkinson Co., Atlanta, Ga.

REPAIR PARTS AND CASTINGS
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Machine Co., Aurora, Ind.

SACKING UNITS
Sackett & Sons Co., The A. J., Baltimore, Md.

SCALES—Including Automatic Baggers
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Machine Co., Aurora, Ind.

SCREENS
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman Foundry and Machine Co., Aurora, Ind.

SEPARATORS—Air
Sackett & Sons Co., The A. J., Baltimore, Md.

SOIL TESTING APPARATUS
La Motte Chemical Products Co., Baltimore, Md.

SOIL CONDITIONERS
American Polymer Corp., Peabody, Mass.

SPRAYS
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Spraying Systems Co., Bellwood, Ill.

STORAGE BUILDINGS
Marietta Concrete Corporation, Marietta, Ohio

SULFATE OF AMMONIA
American Agricultural Chemical Co., N. Y. C.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Nitrogen Div., Allied Chemical & Dye Corp., N.Y.C.
Inland Steel Co., Chicago, Ill.
Jackle, Frank R., New York City
Koppers Co., Inc., Tar Products Div. Pittsburgh, Pa.
Lion Oil Co., El Dorado, Ark.
McIver & Son, Alex. M., Charleston, S. C.
Phillips Chemical Co., Bartlesville, Okla.
United States Steel Corp., New York City
Woodward & Dickerson, Inc., Philadelphia, Pa.

SULFATE OF POTASH—MAGNESIA
International Min. & Chem. Corp., Chicago, Ill.

SULFUR
Ashcraft-Wilkinson Co., Atlanta, Ga.
Gen. Chem. Div., Allied Chem. & Dye, N. Y. C.
Texas Gulf Sulphur Co., New York City
Ashcraft-Wilkinson Co., Atlanta, Ga.
Woodward & Dickerson, Inc., Philadelphia, Pa.

SULFUR—Dusting & Spraying
Ashcraft-Wilkinson Co., Atlanta, Ga.
U. S. Phosphoric Products Div., Tennessee Corp., Tampa, Fla.

SULFURIC ACID
American Agricultural Chemical Co., N. Y. C.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
International Min. & Chem. Corp., Chicago, Ill.
Lion Oil Company, El Dorado, Ark.
Monsanto Chemical Co., St. Louis, Mo.
McIver & Son, Alex. M., Charleston, S. C.
Southern States Phosphate Fertilizer Co., Savannah, Ga.
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
Virginia-Carolina Chemical Corp., Richmond, Va.

SUPERPHOSPHATE
American Agricultural Chemical Co., N. Y. C.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Davison Chemical Corporation, Baltimore, Md.
International Min. & Chem. Corp., Chicago, Ill.
Jackle, Frank R., New York City
McIver & Son, Alex. M., Charleston, S. C.
Southern States Phosphate Fertilizer Co., Savannah, Ga.
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
Virginia-Carolina Chemical Corp., Richmond, Va.
Woodward & Dickerson, Inc., Philadelphia, Pa.

SUPERPHOSPHATE—Concentrated
Armour Fertilizer Works, Atlanta, Ga.
International Min. & Chem. Corp., Chicago, Ill.
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
Virginia-Carolina Chemical Corp., Richmond, Va.
Woodward & Dickerson, Inc., Philadelphia, Pa.

TALC
Ashcraft-Wilkinson Co., Atlanta, Ga.

TANKAGE
American Agricultural Chemical Co., N. Y. C.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
International Min. & Chem. Corp., Chicago, Ill.
Jackle, Frank R., New York City
McIver & Son, Alex. M., Charleston, S. C.
Woodward & Dickerson, Inc., Philadelphia, Pa.

TEPP
Monsanto Chemical Co., St. Louis, Mo.
Virginia-Carolina Chemical Corp., Richmond, Va

TOXAPHENE
Ashcraft-Wilkinson Co., Atlanta, Ga.
Gen. Chem. Div., Allied Chem. & Dye, N. Y. C.

2, 4-D
Gen. Chem. Div., Allied Chem. & Dye, N. Y. C.
Monsanto Chemical Co., St. Louis, Mo.

2, 4, 5-T
Gen. Chem. Div., Allied Chem. & Dye, N. Y. C.
Monsanto Chemical Co., St. Louis, Mo.

UREA & UREA PRODUCTS
Carnegie Chemical Mfg. Co., Los Angeles, Cal.
Nitrogen Div., Allied Chemical & Dye Corp., N.Y.C

VALVES
Atlanta Utility Works, The, East Point, Ga.
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Sackett & Sons Co., The A. J., Baltimore, Md.

ZINC SULFATE
Tennessee Corp., Atlanta, Ga.

Alphabetical List of Advertisers

Answering a query:

What Those Symbols Mean to Readers

Ever notice those little symbols with the letters "ABC" and "ABP" on page 3 of FARM CHEMICALS? Recently a reader asked what the symbols stand for.

This is a good time to explain, for next month is "ABC Month" and member publications throughout the country are taking time out to tell their readers and advertisers what membership in the organization means to them. In addition, the Associated Business Publications (the other symbol which appears on our masthead) is supporting the project and at the same time giving its reasons for existence.

Audit Bureau of Circulations

The symbol at the left is the insignia of the Audit Bureau of Circulations. It has been in existence since 1914. FARM CHEMICALS joined a year ago this month. Before 1914 there was no generally accepted means of measuring a publication's circulation. Loose claims by some publishers tended to fool readers and advertisers as to how many and what type persons read magazines. A group of publishers and advertising men formed ABC to provide standards of practice in circulation for the benefit of readers, advertisers and publishers.

ABC auditors make annual audits of member publications, enabling a judgment of the publication's worth based on definite standards and values. ABC statements not only tell who reads a publication and where it goes; they provide also a behind-the-scenes force which promotes high editorial standards for articles printed in the magazine.

Associated Business Publications

In the same way, the Associated Business Publications provides a real service to all who are concerned with the publication. Backbone of the organization, which was formed in 1916, is a Code of Ethics which guides the publisher in putting out his magazine. It stresses first the consideration of the reader and the importance of honesty in all departments of the publication.

Members must adhere to strict standards of practice. According to these standards, the magazine must refuse to publish paid "Write-ups" and to measure all news by the standard: "Is it real news?" The publisher must make available to all advertisers complete information about advertising rates to prevent discrimination between advertisers.

FARM CHEMICALS thinks its readers and advertisers will find its membership in ABC and ABP valuable in our attempt to provide a better magazine for all our readers and advertisers in the fertilizer and pesticide industries.

METHODS AND RESULTS

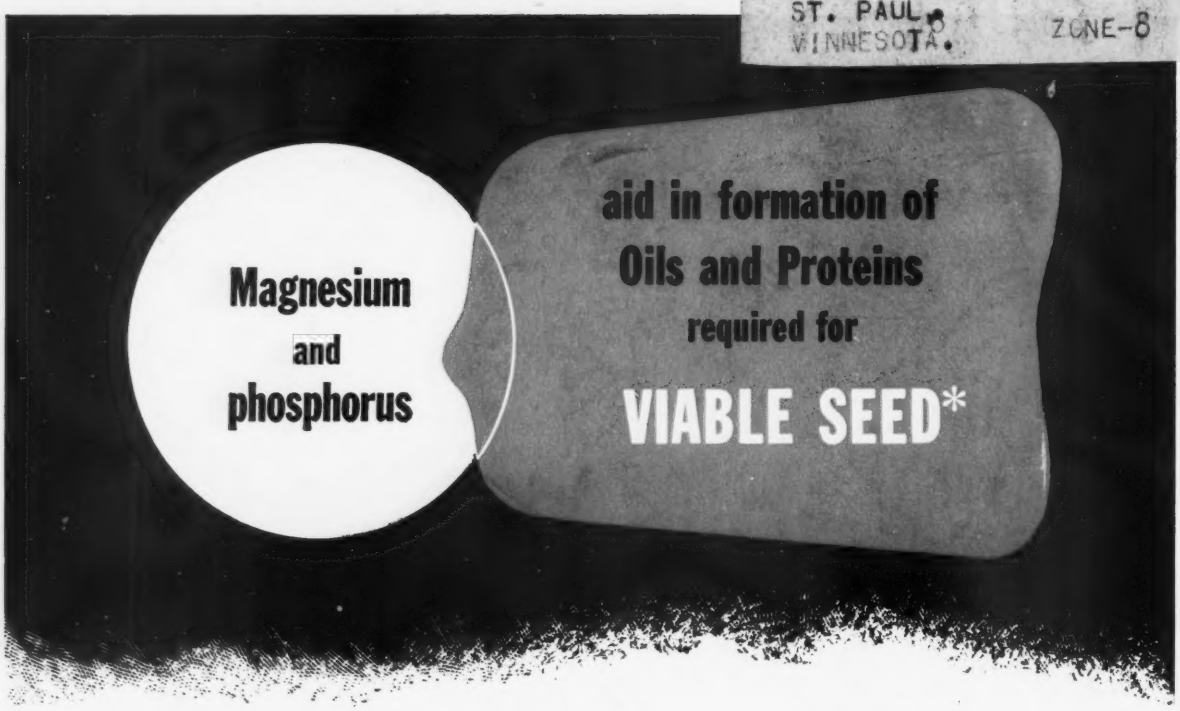
Many different methods of promoting Grasslands Farming are being pursued. All promote greater productivity and profit for our farms.

The program shows tangible results in millions of acres of improved pasture land and greatly increased farm income.

To the agencies who initiated and are successfully spreading the gospel of "Green Pastures" we pledge our continued support.

POTASH COMPANY OF AMERICA
Carlsbad, New Mexico

GENERAL SALES OFFICE...1625 Eye St., N. W., Washington, D. C
MIDWESTERN SALES OFFICE...First National Bank Bldg., Peoria, Ill.
SOUTHERN SALES OFFICE...Candler Building, Atlanta, Ga.



Include Soluble Magnesium in Your Quality Fertilizers

Sul-Po-Mag®

Water-Soluble
Double Sulfate of Potash-Magnesia

Magnesium is the basic metallic element in chlorophyll, the green plant substance which captures the sun's energy that is vital for life and growth.

* Magnesium concentrates in the seed with phosphorus to aid in the formation of oils and proteins required for viable seed.

Magnesium functions as a carrier of phosphates to the actively growing and fruiting parts of the plant.

Magnesium is required to activate the processes which stimulate the production and transport of carbohydrates and proteins within the growing plant.

Magnesium, in sufficient quantities, enables the plant to utilize other plant nutrients for healthy, disease-resistant growth.

Magnesium stimulates the growth of soil bacteria and increases the nitrogen-fixing power of legumes.

To grow big yields of high-quality seed crops such as corn, small grains, cotton and soybeans, there must be an ample supply of magnesium in the soil. Magnesium plays an especially important part in seed formation. As the plant matures, magnesium concentrates with phosphorus in the seed to produce the proteins and oils that are required for plump, viable seeds. Almost all plants need more magnesium than calcium in their seeds, and often more magnesium than either phosphorus or sulfur. Seeds of an oily nature, soybeans and cottonseed for example, have a particularly high magnesium requirement.

If soils are deficient in this vital plant nutrient, the farmer must supply it in order to get maximum quality and yield. He can do this most efficiently and at less cost by using a fertilizer containing soluble magnesium.

Many manufacturers of quality fertilizers have found that by far the most practical and effective way to supply soluble magnesium is to include *Sul-Po-Mag* in their mixtures for crops grown on magnesium-deficient soils. *Sul-Po-Mag*, produced exclusively by *International*, is a properly balanced source of magnesium and potash, both in sulfate form, water-soluble and immediately available to growing crops. It is supplied for use in mixed fertilizers and also bagged for direct application to the soil.

More and more farmers are asking for fertilizers containing *Sul-Po-Mag*. You'll be doing your customers a real service by using *Sul-Po-Mag* in the complete plant foods you mix for magnesium-deficient soils.

International Minerals & Chemical

MURIATE OF POTASH
SULFATE OF POTASH
SUL-PO-MAG

Mined and Refined at Carlsbad by International for Fertilizer Manufacturers

POTASH DIVISION

INTERNATIONAL MINERALS & CHEMICAL CORPORATION
General Offices: 20 North Wacker Drive, Chicago 6